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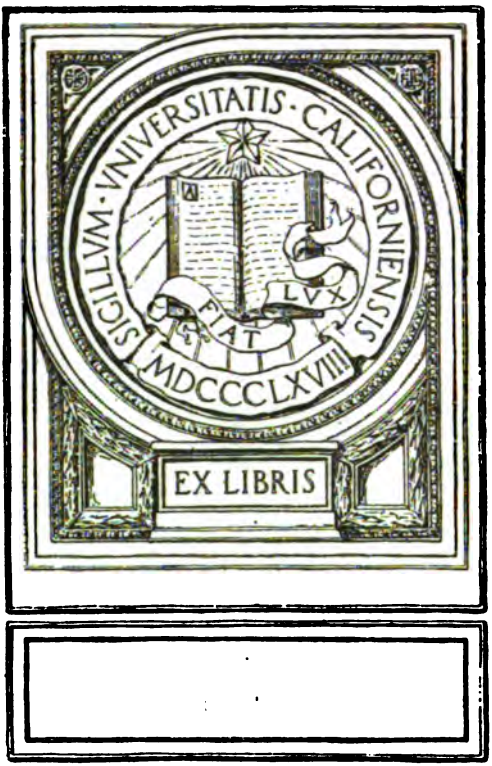
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NATURAL EVIDENCE

OF

A FUTURE LIFE,

&c.

LONDON:
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NATURAL EVIDENCE

OF

A FUTURE LIFE,

DERIVED FROM

THE PROPERTIES AND ACTIONS OF ANIMATE AND INANIMATE MATTER.

A CONTRIBUTION TO NATURAL THEOLOGY,

DESIGNED AS

A SEQUEL TO THE BRIDGEWATER TREATISES.

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BY

FREDERICK C. BAKEWELL,

AUTHOR OF PHILOSOPHICAL CONVERSATIONS, ETC.

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PREFACE.

THOUGH our literature abounds in excellent treatises on Natural Theology, there are scarcely any works wherein the evidences which constitute the foundations of that science have been adduced to prove that the existence of man is not limited to his present transitory state of being. It may, indeed, be regarded as an extraordinary circumstance, that although so many learned divines and men of science have directed their attention to the subject, with a view to deduce from the structure and functions of the human frame, and from the operations of Nature, the existence of a supremely intelligent and powerful Creator of the universe, they should, apparently, have neglected or overlooked the same sources of evidence in their researches respecting the ulterior objects for which man was created.

The question is admitted to be the most important that can engage the attention of human beings. The moral philosopher and the metaphysician have consequently endeavoured, by arguments founded on the moral attributes of the Deity and the constitution of the human mind, to arrive at that momentous truth which directs us to look beyond this world to another and a superior state of existence. The exclusion of natural phenomena from these considerations must, therefore, be ascribed to the impression, too hastily received, that the evidence to be derived from the actions of matter is either not favourable to, or, at least, that it affords no satisfactory proof of, the immortality of the soul.

This ground of argument has, indeed, been so long occupied by those philosophers who ascribe the phenomena of life to material agency alone, that their exclusive possession of it seems to be sanctioned by prescription; and the utmost that has been attempted in this branch of the science of Natural Theology has been, to resist the assaults they are enabled to make from that commanding position. It may be confidently affirmed, however, that by abandoning this ground to the materialists, the advocates of natural reli-

gion not only concede to their opponents an advantage to which they have no valid claim, but that they relinquish one of the strongest positions on which the future existence of the soul can be maintained, independently of Revelation.

The results to be attained by a careful examination of natural phenomena, afford, it is conceived, the best answer that can be given to the objections urged against the immateriality of the sentient principle; for if it can be shown that the balance of evidence derived from those phenomena preponderates in favour of the existence of an immaterial, indestructible agency, distinct from matter and from animal organisation, that truth will be thus established on the very ground on which alone it is attempted to be disputed. To accomplish this object — to deduce from the consideration of the ulterior and more hidden causes of physical processes and of the animal functions, the existence of the mind after death — is the design of the present work.

The consideration of the nature of that existence — whether it be purely immaterial, or whether the living principle be united with some material form — does not enter into this branch of the subject. It is a question which, so far as it can be investigated by the limited faculties

of man, peculiarly belongs to psychological science. Neither is it within the scope of this work to inquire respecting the objects of a future state, nor into the conditions on which it will be enjoyed. Those questions lie exclusively within the provinces of moral science and of revealed religion.

The proposition now to be affirmed is simply this; — that the evidences to be derived from the consideration of the properties of matter, and the functions of the corporeal organs, are sufficient to prove that the mind survives the dissolution of the body. If this proposition can be satisfactorily demonstrated by the inductive process of reasoning from a variety of facts, it will form a solid foundation whereon to rest those arguments in favour of natural religion which are derived from the attributes of the Deity and the moral constitution of man; and it will receive additional value from being established on the ground usually considered to be the stronghold of the opponents to the natural immortality of the soul.

In treating a subject like the present, which has relation to metaphysical as well as to physical science, it may be readily conceived that no

small degree of difficulty would arise in stating the evidence advanced, and in tracing the inferences to be drawn from it, in such a manner as to be intelligible to all classes of readers. To prevent any unnecessary mystification, the technicalities of science have been carefully avoided, and no exemplifications have been introduced that cannot be generally understood by the accompanying explanations. It has been the author's endeavour to present the subject in all its bearings, in the most intelligible form, and in the clearest light. With this object in view, the work has been divided into three parts; the two first of which relate to matter and its properties in the inorganic state; and the last, to the manifestations of the living and intellectual principles, by a system of organised material particles. As the several divisions of the subject have reference to the existence of the soul in a future state of being, and as each of the minor branches into which they are subdivided also points to the same conclusion, it has been almost impossible to avoid occasional restatement of the propositions and arguments, as the consideration of the evidence has proceeded. If, however, this arrangement have the effect of

producing a clear elucidation of the subject, and of impressing the arguments with additional force on the mind, the object for which it was adopted will be attained, and the objections attending the consequent repetitions will be amply counterbalanced.

Haverstock Terrace, Hampstead,
December, 1835.

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INTRODUCTION.

When we attempt to investigate the causes of any known phenomena, we are quickly arrested in our progress by the subtile nature of the inquiry, and we very soon arrive at the extreme limits to which our researches can extend. Those limits are more or less circumscribed, in proportion to the acquired knowledge and the natural capacity of the inquirer; but, however enlarged his capacity, or however extended his knowledge, he will not be able to advance beyond a certain, and not far distant, point in the train of causation, and he will then be obliged to admit that the final causes of which he has been in pursuit lie beyond the reach of his intellectual powers. A similar result follows every analytical inquiry into the causes of even the simplest natural phenomena; and the primary cause of the falling of a stone to the ground is as inexplicable as that of the most intricate phenomena of life. We may, indeed, ascertain that what is termed the *attraction of gravitation* draws the stone to the earth; we may discover the laws by which that attraction is regulated; and, by

extending our views, we may learn that the system of the universe is upheld by the immediate influence of that power; but when we inquire into the nature of the power itself, the philosopher is as much at a loss for an explanation as the uneducated savage. He finds that there are agents in constant operation around him too subtile to be appreciated by any of the organs of sense, and which are only perceptible by their effects; and having by attentive observation of those effects discovered the laws which govern the mysterious powers, he is obliged to rest satisfied with the knowledge that such powers exist, without being able to form any conception of their nature or modes of operation.

Every phenomenon in physical science directs us in this manner to look beyond material existences for its ultimate cause. The manifestations of design, of power, and of wisdom, in all the inanimate works of creation, teach us that there exists a supreme Intelligent Cause, by whose energies all things were created and are preserved. The subtile properties of matter are thus alone sufficient to show that there exists some power beyond the cognisance of our senses; and the uses to which those properties are applied inform us, that that power must be supremely intelligent and efficient.

When we ascend from inanimate creation to consider the wonderfully complicated organis-

ation that accompanies the manifestation of animal life, the proofs of wisdom and of power are still more conspicuously displayed; and when we further consider the adaptations of external circumstances to the support and enjoyments of living beings, the attribute of infinite benevolence must be added to those of omniscience and omnipotence. In these considerations we are irresistibly led "from nature up to nature's God;" and the proofs of the existence of a spiritual Creator and Governor of the universe are based on the clearest deductions of human reasoning.

It is from this point, therefore, that we set out in our present investigations. We take for granted that there exists an all-wise, all-powerful, and an infinitely good and benevolent Being, who created and presides over all things. The examination of the properties of matter, and of the phenomena of life, afford the most satisfactory evidence of this fundamental truth; and we now propose to derive from the same sources which furnish proofs of the existence and attributes of a supreme First Cause—superior to and independent of the material world—evidence to prove that the soul of man is also distinct from, and independent of, any organised system of matter.

When we perceive a friend, whom we have loved and admired for his virtues and his talents,

cut off by the hand of death in the full enjoyment of his corporeal and mental faculties, — when we see his body lying before us cold and lifeless, and when we reflect that in a short time even that memento of his existence will be decomposed and destroyed, — we anxiously inquire, are the powers of perception and consciousness, the intellectual faculties, and the moral feelings and affections, that were so recently manifested in this material form, annihilated; or are their functions continued in some other state of being, independently of material organisation?

If we were to confine our views to the phenomena immediately presented to our senses, and were to reason exclusively from a superficial observation of the changes in the constitution of the body consequent on death, we should be led to the conclusion that the destruction of the body involves also the eternal destruction of the mysterious principle by which it was animated. The only means we possess of ascertaining the existence of sensation and intellect in other men being the outward manifestations of those qualities by corporeal organs, when those agents are entirely decomposed, all indications of the continuance of such qualities are also necessarily destroyed. Those inquirers, therefore, who terminate their researches with the examination of immediate visible effects,

directly conclude that death is accompanied by the annihilation of the soul. We contend that it is upon this contracted view alone of the processes accompanying the dissolution of the body, that the hypothesis of the materialists can be supported; but such a consideration of the subject is only suited to the rudest ages of ignorance, and will be found to be directly opposed to the plainest deductions from all scientific investigations.

The difficulties which attend every attempt to discover the ultimate causes of any phenomenon, are particularly observable in the investigations of the nature of the changes consequent on death, which soon lead us from the consideration of immediate material agency to other and more remote causes, that baffle the penetration of the most acute human intellect.

Should we, in the first place, discover that the putrefactive decomposition of the animal solids and fluids, which apparently terminates in the destruction of the whole substance that constituted the corporeal frame, is merely an intermediate process, whereby the numerous simple elements that entered into the composition of the body are resolved into other compounds; this first step in our inquiry would lead directly to the operation of ulterior causes competent to effect those changes. Let us, for the present, assume that this process is effected by the agency of reciprocal attractions

subsisting among the elementary atoms of different substances, and that the infinitely varied animal compounds are decomposed and rearranged by the operation of those attractive powers; it would then appear that the only effect of putrefaction is to vary the combinations of the ultimate elements — not to destroy them; and that not one particle of the matter which formed a component part of the animal frame at the moment of death, is lost by the decomposition and subsequent dissipation, which appears, on a superficial view, to annihilate the whole mass. Should it also be ascertained that not only are the elementary particles of matter preserved entire during the decomposition of the body, but that the results of a variety of analytical experiments lead us to infer that it is *impossible*, by any known process, to destroy or to change the elementary atoms of any material substance; the investigation respecting the ultimate causes of putrefactive decomposition would thus directly contradict the *primâ facie* evidence of the senses; and instead of affirming the opinion that the material composition of the human frame is annihilated after death, it would prove that the original elements are indestructible and unchangeable.

After considering the indestructible nature of matter, if we direct our attention to those properties which distinguish one kind of material

substance from another, and which are the immediate agents in all the processes of Nature — when we turn from the mere inert substance of the animal body to examine the causes of those changes which take place in its composition after the principle of life is fled — we shall perceive the inadequacy of the human intellect to apprehend such subtile agencies, and we shall obtain additional proofs of the fallacy of the first impression that death and annihilation are identical.

If it should be found that every active agent engaged in the process of decomposition, or in rendering that process manifest to our senses, is distinct from inert matter, and is too subtile to be appreciable by corporeal organs; then the knowledge of the existence and operation of invisible agents, which excite and regulate the changes observable in the constitution of the material body, would oblige us to look beyond the immediate effects and causes to unknown and inscrutable agencies. If, for instance, it should be found that chemical attraction, that power which induces those changes indicated by decomposition — if heat, which enables that property of matter to exert its energies — if light, through the medium of which we see the results of the process — if these agents are discovered to be subtile principles, connected with, but abstractly independent of, matter, the changes consequent on death, so far from being indica-

tions of annihilation, would become exemplifications of the presence and action of some other power that is too mysterious and inscrutable for investigation.

If it should be found, in addition, that every known property of matter is, equally with the properties of attraction, heat, and light, distinct from matter itself, and consists of some active, subtile principle governed by peculiar laws, the natural inference to be drawn from these facts would be, that the higher qualities developed by the organic combination of many of those properties must be distinct from the matter organised; and were we to add to these characteristics of the properties of material bodies, the attribute of indestructibility, and were thus to ascertain that all the changes and dissolutions in Nature are but intermediate processes in the formation of other substances, we should possess the strongest analogical evidence for the assumption that the vital and thinking principles are as indestructible as matter, and that their combination with, and separation from, material organisation, are merely preparatory to entering another state of being.

Supposing those positions, which have been hypothetically assumed, to be well established, we contend that the same process of reasoning by which we arrive at any general truths in physical science would directly lead us to infer, from those collective analogous instances, the

immortality of the soul. This inference, it must be further observed, is founded solely on the consideration of the changes in the forms of matter consequent on death, without any reference to the active operation of the vital, sentient, and intellectual principles. Having, then, traced the results of the decomposition of the corporeal frame, and noticed the conclusions to which this view of the subject would lead, we shall, in the next place, have to examine attentively the phenomena of life; which are the only indices we possess of the existence and powers of the mind.

Now it must be evident, that as the existence of an immaterial subtile principle cannot be perceptible by material organs when not combined with matter, it is impossible to have demonstrative proof of the continued existence of the soul after its separation from material substance. The proofs of that separate existence, which are to be derived from material phenomena, must consequently be founded on induction from analogous facts; but when that reasoning process is well sustained, by numerous closely approximating analogies, the propositions which are thus affirmed become scarcely less satisfactory than positive demonstrations.

Should it be found, for instance, that the phenomena of vegetation, and of animal organisation, are caused by the agency of some subtile

principle, not only distinct from matter, but distinct likewise from any of the known properties of matter; that the sentient principle is distinct from the organs of sensation, and from the medullary substance of the brain; that the power of consciousness, and the faculties of memory and of thought, are also distinct from matter, and that the perceptive faculties may be brought into action independently of the external organs that are specially adapted to their developement; if, in short, it should be found that the corporeal organs are merely instruments that assist in the developement of some higher and inscrutable power, we may surely infer, with a degree of certainty equal to that which attends any conclusions in physical science, that this superior power—which we designate the soul—is distinct from material organisation, and that its existence does not depend on those subservient agents which manifest its presence. The relations of material organs to the soul may, in this view of the case, be not inaptly compared to those subsisting between the microscope and the objects which are only visible by its means: as those objects are not affected by the destruction of the instrument that renders their existence perceptible, neither is the immaterial principle in man destroyed by the dissolution of those material organs through whose agency alone he becomes conscious of their existence.

To substantiate the facts that have been thus assumed, and to establish the validity of the inferences to be drawn from them, are the objects now proposed to be accomplished. We shall, in the first place, endeavour to show that all matter is indestructible; secondly, that all the known properties of matter are subtile agents, distinct from mere extension, solidity, and divisibility, which are the sole abstract characteristics of inert matter. Having then shown that all material substances themselves contain a subtile principle different from mere abstract matter, and that annihilation is incompatible with the known laws of Nature, we shall proceed to consider the connection of the immaterial principles of vitality with material organisation, and to prove that they are not only distinct from, but that, even during the continuance of that connection, the percipient and intellectual powers are to a certain extent independent of the corporeal organs.

In pursuing this course of inquiry, it is not intended that we should enter the province of the moral philosopher. He may arrive at the same conclusions by reasoning upon the attributes of the Deity, and the moral constitution of the human mind. He may justly infer, from the admirable manifestations of design and contrivance in the developement of the living principle, that it was created for further purposes

than the transient and apparently useless existence in this world; and that the attributes of benevolence, of goodness, and of justice, of the Supreme Creator, would not be reconcilable with a scheme of philosophy which would limit the existence of man to the trials, miseries, and persecutions, to which he is subjected in the present life. As our object, however, is confined to the evidence to be deduced from the phenomena of material bodies, we are excluded from those important considerations to which we have just adverted. The arguments to be derived from psychological considerations, respecting the nature, powers, and actions of the human mind, are also not available in our inquiries, excepting in those instances wherein mental operations are indicated by external signs. We are thus precluded by the nature of our subject from those arguments, by means of which the moral philosopher and the metaphysician arrive at the same conclusions that we endeavour to attain from the examination of material agencies; but the results of their inquiries may, at least, be referred to, in a general view of our subject, as corroborative proofs, derived from different sources, tending to give the impress of absolute certainty to those conclusions at which we arrive, from the consideration of the well-known properties and phenomena of matter.

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NATURAL EVIDENCE,

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PART I.

THE INDESTRUCTIBILITY OF MATTER.

CHAPTER I.

PRELIMINARY OBSERVATIONS.

In accordance with that arrangement of our subject which it has been proposed to adopt, we shall commence our investigations by examining the results of chemical action, for the purpose of showing that the elementary atoms of which all material bodies are composed are indestructible.

We are indebted to chemistry for the indisputable proofs which we possess of the imperishable nature of matter; and there is no truth brought to light by this important science that can be of greater interest to mankind. It is now ascertained, and is capable of the clearest proof, that the simple elements, of which all substances are composed, cannot, by any con-

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ceivable means, be destroyed. They may, indeed, be so changed as to present not the least resemblance to their previous forms — they may be so mingled with other bodies that their identity cannot be traced — and they may be dissipated into invisible vapour, and be apparently annihilated — but we learn, from the science of chemistry, that in every change the same elements remain, inextinguishable and unaltered.

If, then, the material bodies, which are the objects of our senses, notwithstanding their continual decompositions and alterations of form, can be proved to be essentially indestructible, and in their elements incapable of change, we may surely infer that the subtile, or immaterial, properties of matter — in which no alteration can be perceived, and whose existence can only be known to us by their invariable effects — are also eternal in duration and unalterable in their natures. As an illustration of this position, let it be admitted that matter is indestructible and unchangeable, and can we refuse to admit the possession of the same attributes to gravitation, which is a universal property of matter, though it is inscrutable to the human faculties, and is known only by its effects? Can we admit that the elements composing the globe we inhabit are imperishable — though we see all the bodies on its surface for ever decaying — and doubt for a moment the indestructible nature of the power

of attraction, by whose agency the world is maintained in its form and preserved in its orbit, and which must have existed unchanged since the creation of the universe?

Having advanced thus far, and been compelled to grant that attraction, a subtile property of matter — whether we regard it as a material or as an immaterial substance — must be equally indestructible with matter itself; let us proceed a step farther, and consider whether this evidence will not be equally conclusive in favour of the imperishable nature of the sentient principle. For if it can be satisfactorily proved that the elements of all visible objects are indestructible, and that the subtile properties of matter are also indestructible, may we not reasonably infer that the sentient principle, which acts upon inert matter, must be equally durable with the inferior substance over which it exercises complete control?

This argument will apply with equal force, whether we consider the mind to be a material substance or to be immaterial. For if we agree with those philosophers who believe the sentient principle to constitute one of the properties of matter, on that supposition — if matter and its properties can be proved to be indestructible — the sentient principle, being one of those properties, must also be imperishable. If, on the other hand, we reject the opinions of the mate-

rialists, and conceive the vital principle to be an immaterial essence, capable of being united with and of controlling matter; then the inference in support of our argument, to be drawn from the equal duration of the superior to the inferior substance, derives additional strength. We shall not, in this branch of our subject, have to take into consideration the opinions of those who conceive the effects of sensation and all the functions of animal and intellectual life to be produced by, and to be entirely dependent upon, a peculiar organisation of matter. Our present object is to prove that nothing which exists perishes, and thence to infer that the sentient principle — by means of which alone we have knowledge of existing objects — must also be indestructible, whether its nature be material or immaterial. In the following pages, therefore, it will be our province to show that the decay and apparent destruction of objects, continually observed, are only so many changes in the forms of matter, and that matter itself remains unimpaired and unchangeable.

Before we describe, however, the effects of chemical action, it will be advisable, for the more perfect elucidation of our subject to those of our readers who may be unacquainted with the rudiments of chemistry, briefly to explain the principles on which all chemical action depends; and we shall then feel assured that the

rationale of the phenomena alluded to in the course of our investigations is generally understood.

The operating cause of all chemical combinations is attraction ; — that same power, by the influence of which all visible objects are retained in their existing forms, which regulates the motions of the planets, and upholds the system of the universe. The force of attraction, however, has different modes of operation, and it has been usual to consider it as consisting of three distinct kinds, viz. *attraction of cohesion*, *attraction of gravitation*, and *chemical attraction*. The difference between the attraction of cohesion and chemical attraction appears to be this : the attraction of cohesion acts only mechanically, by holding the particles of matter composing the same substance together, to form an aggregate mass of those particles when brought into close contact, without effecting any change in the nature of the particles themselves ; whereas chemical attraction operates among the constituent particles of different substances, and, by causing their elements to form other combinations, produces a change in the nature of those substances. Thus the attraction of cohesion may be considered as acting only on the surfaces of the minute particles of bodies, whilst chemical attraction exerts its influence in their internal composition. The attraction of cohe-

sion, therefore, as it acts only externally, may be destroyed by mechanical means; but no mechanical division, however minute, can separate the combinations effected by chemical affinity; and these combinations can only be altered by the operation of other chemical attractions more powerful than those exerted in forming the combination to be operated on.

The attractions of cohesion and of chemical affinity are not only different in their modes of action, but they directly oppose their respective operations. Neither of these kinds of attraction can act until the particles of the substances to be operated on are brought into the closest contact; consequently, the attraction of cohesion, by holding the particles of bodies together in a mass, prevents their exposure to the influence of chemical attraction, and it is generally necessary to destroy the cohesion of bodies before chemical action can be effected.

Chemical attraction, also, possesses the peculiarity of being more strongly exerted among the atoms of some bodies than among those of others. Thus, the atoms of one substance that will unite with avidity with those of another substance, to which it has what chemists term a strong affinity, cannot be brought to combine with a different body. The particles of oil and water, for instance, cannot by any mechanical means be forced to combine, but seem, on the

contrary, to be influenced by some repulsive principle that keeps them asunder. We know, however, that water will mix readily with most fluids, and that oil will freely unite with turpentine, and with some other liquids; therefore the apparent repulsion existing between the particles of oil and water does not arise from the absence of attractive power, but from the circumstance that the attractive powers they respectively possess are not of such a nature as to act on each other. This difference in the reciprocal attractive powers of different bodies is the general cause of chemical action; for when bodies possessing various degrees of chemical affinity towards each other are placed in circumstances that enable them to exert their respective attractions, those elements that possess the strongest reciprocal affinities unite, and leave the particles with which they were previously combined; and the result of this new arrangement will be a fresh compound, frequently possessing completely different properties from those of any of the bodies brought into action.

If in the foregoing brief explanation of chemical affinity we have succeeded in rendering that chief agent of chemical action intelligible, little difficulty will arise in understanding the causes of the phenomena to be hereafter adduced in illustration of this part of our subject.

It will be found that the change, the decomposition, and the apparent annihilation of bodies are merely the effects of different combinations among the ultimate atoms of matter, resulting from their respective attractions. The rapidity with which these phenomena are produced, depends upon the degree of attraction subsisting between the particles of the bodies brought into action; but whether these changes are effected by the slow progress of time, or by instantaneous combustion, the cause that produces them is the same; and we shall find that, in every known instance of decomposition, the elementary particles of matter have undergone no diminution, and that it is not possible for them to be changed or destroyed.

CHAPTER II.

SOLUTION.

THE process of solution presents the simplest exemplification of the power of chemical affinity. The only condition requisite to effect solution is, that the solvent should possess a sufficient degree of affinity to the substance to be dissolved, to overcome the attraction of cohesion among its particles. In some instances the attractive power of the solvent liquid is so weak that it cannot act upon the body to be dissolved until the attraction of cohesion existing between the particles of the latter is diminished, by reducing it to an impalpable powder. Even in this case, however, it is requisite that the chemical affinity subsisting between the solvent and the body to be dissolved be sufficiently powerful to overcome the cohesive attraction of the minute particles of the powder, or no solution would take place; and this condition is indispensably necessary to solution, whatever be the nature of the solvent or of the body acted on.

The phenomena of solution afford some of the most obvious illustrations of complete changes produced in bodies without causing their de-

struction; yet we are so much accustomed to see these changes, that though the substances dissolved can no longer be recognised, and are rendered perfectly invisible in their new condition, we never for a moment suppose that any particle of them is lost.

The solution of a lump of sugar in a cup of tea may be adduced as a familiar illustration. The hard crystallised sugar is dropped into the tea, and after a short interval it wholly disappears. Were a person to witness such a phenomenon for the first time, he would consider the sugar to be totally lost, and he might be disposed to attribute its disappearance to magic. We are, however, so well acquainted with the process, that we cease to regard the phenomenon as worthy of notice, and feel confident the sugar has lost none of its properties by the chemical action, which renders it imperceptible to the organs of sight and touch. If the lump of sugar be dissolved in a glass of water, we may perceive the solid crystallised mass gradually disappear, until no visible indication of its existence remains, and the water will then appear as limpid as at first. The presence of the sugar may, however, be detected, not only by the taste, but by the weight of the water, which will be found to have increased in exact proportion to the weight of the sugar dissolved. The saccharine matter may, indeed, be reproduced in a

solid form, by evaporating the solution to dryness, when the residue will consist of crystals of sugar, which will be found to weigh exactly the same as the original lump. The sugar in this case is not, indeed, reproduced in the identical form that it previously possessed, but it is in all respects, with the exception of the arrangement of its particles, the same as before solution; and the resemblance might be made more close by conducting the process of evaporation in a vessel that would bring the crystals, as they form, into contact, by which means they would compose a solid lump.

The foregoing is an illustration of one of the most simple changes produced in the constitution of bodies by chemical action. In consequence of the frequent recurrence of the process it fails to make any impression on the mind, and we may be disposed to wonder that it should excite observation. Yet the change the sugar undergoes is so great, and it is in appearance so completely destroyed, that if we had no means of detecting its presence in the water, we might imagine that solution was identical with annihilation.

We will adduce another and less familiar instance of the total disappearance of a solid body by solution. If a piece of silver be immersed in diluted nitric acid, the affinity of the acid to the metal will occasion them to unite; a brisk action

will ensue, and in a short time the silver will be entirely dissolved. The liquid will remain as limpid as before, and will present no difference in its appearance, to indicate a change. What, then, has become of the solid piece of silver that was placed in the liquid? Its hardness, its lustre, its tenacity, its great specific gravity, all the characteristics that distinguished it as a metal, are gone; its very form has vanished; and the hard, splendid, ponderous, and opaque metal, that, but a few minutes since, was immersed in the mixture, is apparently annihilated. Must we conclude that the metal is destroyed, because its presence is inappreciable by our senses? We might, perhaps, be disposed to arrive at such a conclusion, if we were unacquainted with the means of restoring the silver to its metallic state, or were ignorant of any test that might indicate its presence in the fluid; or were unable, from analogous phenomena, to infer that its elementary particles exist unchanged, and have merely undergone a different state of combination. Chemical science, however, not only affords us innumerable analogical proofs that the metal is not destroyed, but enables us to reproduce it from the solution, undiminished in weight, and possessing the lustre and other properties by which it was previously distinguished; and thus to place the question of its being suspended in the liquid beyond the possibility of a doubt.

The reproduction of the silver may be effected by introducing some pieces of copper into the solution, to which metal the acid has a stronger affinity than to the silver; and the latter will consequently be disengaged, and fall to the bottom in small brilliant metallic crystals. The quantity thus deposited will be found to correspond exactly with the weight of the metal dissolved, and if the minute particles be melted and cast into the same shape that the piece of silver presented before solution, it will be reproduced, not only the same in substance, and endued with the same properties it possessed before its disappearance in the acid, but even in its pristine form.

It would be of little avail to multiply illustrations of the phenomena of solution, for the purpose of showing that this process does not destroy the particles of matter. The two instances already adduced will sufficiently answer our purpose, though they constitute two only out of innumerable examples that might be produced in proof of the same indisputable fact.

Before we dismiss this branch of our subject, however, it may be as well to direct attention to the fact, that though solution is one of the simplest processes of nature, the limited faculties of man will not permit him to comprehend the mode in which it operates. We are enabled to discover the proximate cause of the process,

and to ascertain that the action of the solvent upon the body to be dissolved is produced by the chemical attractions subsisting between their elementary atoms; but of the nature of that attraction, and of the manner in which it acts, we are profoundly ignorant. In the more intricate phenomena investigated by the chemist, even the proximate causes of their action can only be conjectured; still less can he discover the ultimate modes of operation by which their processes are conducted. There is not one phenomenon of nature that the mind of man can fully comprehend; and after pursuing the inquiry as far as his mental capacity will admit, he is still obliged to confess that there is an operating power beyond the reach of his comprehension. It is of importance in our researches, that we should bear in mind the utter incapacity of man to penetrate the hidden mysteries of nature, lest we be induced to mistake the low level of human knowledge for the summit of omniscience, and should run into the common error of concluding that whatever is incomprehensible to our limited faculties must be impossible.

CHAPTER III.

EVAPORATION.

THE phenomena of evaporation might, strictly speaking, be classed with those of solution; but as the term solution is commonly understood to apply to the action of a fluid on a solid body, we prefer, in the present inquiry, to limit it to its common acceptation, and to treat those phenomena connected with the solution of fluids in aëriform bodies under a separate head.

If the disappearance of a solid substance when immersed in a liquid be calculated to excite surprise, and to induce the belief that it has been destroyed, such an impression is still more likely to be produced by the disappearance of a liquid in the atmosphere, without the slightest indication whither it has vanished. We see, for instance, a drop of rain fall upon the window, we watch it attentively, and perceive it gradually diminish, until the last faint trace of it is lost; — and who can tell, from superficial observation, that it is not lost for ever? Can annihilation be apparently more complete? In the case of the bodies lost by solution, though the solid substance disappears, yet the menstruum in which it is dis-

solved remains; but in this case there is no apparent menstruum with which the water could have mingled; and if we were ignorant of the existence of an aëriform invisible fluid around us, we could not conceive the possibility of the continued existence of a substance, every particle of which we have seen melt away into seeming nothingness, without leaving a trace to mark where it had been.

A knowledge of the nature and properties of air, however, enables us to explain this phenomenon, and to ascertain that the water has only undergone a species of comminution, and has not even been separated into the simple elements of which it is composed.

If any doubt be entertained of this fact, it may easily be removed by the following simple experiment: — Let a drop of water fall into a dry and clean Florence flask, which should be then tightly corked and placed in a warm room. In a short space of time the drop of water will have disappeared, and if the temperature of the room be sufficiently hot, the flask will afford no indication of the presence of water, and will appear to be perfectly dry. If the flask be then removed into a colder temperature, the vapour will be condensed, and appear on the sides of the flask in minute globules, which, if collected, will be found exactly equal to the drop of water first placed within the bottle.

The same process is continually going on in nature. The water on the surface of the earth is constantly evaporating; and, so long as the air is sufficiently heated to retain it in a state of vapour, the aqueous particles in the atmosphere are invisible. When a change of temperature occurs, the vapour is condensed, and forms cloud, fog, or dew, according to the manner and the situation in which the condensation takes place. The clouds are further condensed by subsequent change of temperature, until the minute particles composing them are united into drops; and the water, which appeared to suffer annihilation in its conversion into invisible vapour, again assumes its original form, and, descending to the earth in rain, refreshes its parched surface, and gives additional vigour to the whole vegetable creation.

The effect of evaporation depends, in the same manner as that of solution, upon chemical attraction; and is caused by the affinity subsisting between the particles of the air and those of the liquid evaporated. The liquid is thus dissolved in the atmosphere precisely in the same manner that solids are dissolved in fluids; and the attractions subsisting between different liquid bodies and air, and between air in different states of the atmosphere and the same liquid, vary nearly to the same extent as the chemical affinities between liquids and solids.

Air possesses a much stronger affinity to alcohol (spirits of wine) than to water, and the former consequently evaporates much more rapidly than the latter. If a mixture of spirits of wine and water be, therefore, exposed to the air, it will, in a short space of time, be found to have lost a large portion of the alcohol; and if the exposure be continued, nearly the whole of the spirit will be dissipated in air, whilst the greater portion of the water will remain. This process, when quickened by the application of heat, and the adaptation of proper apparatus for condensing and preserving the product, is termed distillation. A portion of water will always be carried away with the alcohol; and when the spirit is required to be strong, the distillation must be repeated again and again, until the alcohol becomes as free from water as it can be made by this process.

The residuum, after the exposure to the air, or the distillation, of a mixture of alcohol and water, is found to have lost nearly all its more volatile particles. The alcohol has separated itself from the water, has entered into combination with the air, and, in the case of distillation, has been reproduced in nearly its former purity, after having been freed from the grosser particles with which it was previously united. Thus, we perceive that, so far from any destruction of the more subtile properties of the mixture having

taken place, as might be imagined from its disappearance, the result of the process has been merely to separate the grosser liquid from the more subtile, and to restore the latter to its undiluted and ethereal state. Not one atom of the fluid has been destroyed, nor have its elementary particles suffered the least change by the various combinations into which they have entered.

We shall adduce one other instance of evaporation, which we consider worthy of notice, because it shows that one of the heaviest substances in nature may be converted into vapour, and made to float in the atmosphere, invisible to the human eye. If a small quantity of mercury be placed in a crucible on the fire, the liquid metal, on becoming heated, will begin to evaporate; and, on attaining a temperature of about 660° of Fahrenheit, it will become in a state of ebullition, and the vapour will issue from it with great rapidity, until the whole of the mercury in the crucible disappears. As the mercury, however, requires a strong heat for its retention in a state of vapour, it rapidly condenses on coming in contact with the cool air, and falls in minute globules on surrounding substances in its natural liquid metallic form. The process of evaporation, nevertheless, has been completely effected; and if the temperature of the air were raised to the boiling point of mercury, that ponderous metallic body would be retained permanently in an aëri-

form state, and would appear to be entirely destroyed.

The foregoing illustrations of the phenomena of evaporation and distillation will be sufficient to show that those processes neither destroy nor change the elements of the substances operated on; and that, in the case of distillation, the effect of the apparent change in the constitution of the bodies subject to them is, to separate the more subtile from its combination with the grosser fluid, without diminishing the quantity of either. It would be incompatible with the nature of the present work to do more than adduce two or three illustrations of each of the subjects discussed; but similar results are produced, in whatever manner the processes may be conducted. However various the nature of the substances dissolved, or of the liquids evaporated, the chemist is enabled to trace the original elements through all their varieties of combination, and to detect their existence even when they have assumed a form that veils them from the cognisance of the organs of sensation.

CHAPTER IV.

RAREFACTION.

THE processes of solution and evaporation have been shown, in the preceding chapters, to produce only different arrangements in the particles of matter, whilst the elements of matter remain unaltered. Solid bodies disappear in the solvent, and reappear when the solvent has been evaporated: liquids are dissipated into invisible vapour, and are again condensed into their original forms on the abstraction of the heat by which they were vaporised. By the process we are now about to investigate, the dissipation of the particles of matter is more complete than in the foregoing: the compound substances operated on are separated into their elements, one of which is converted by the operation into a permanently elastic and invisible gas.

The conversion of water into gas is the first instance of rarefaction we shall adduce. If a known quantity of water be boiled in a closed vessel, and the steam permitted to pass through a red-hot tube, the end of which is inserted into a basin of cold water, the steam that is formed will be merely condensed. The temperature of the water in the basin, however, will rapidly

increase, until it becomes too hot to condense a further quantity of steam ; and it will be found to have gained in weight in exact proportion to the loss of the boiling water. If a quantity of fresh iron turnings be then forced into the heated tube, and the experiment be repeated, a number of bubbles will rise through the water, in rapid succession, from the end of the tube. These bubbles will emit a strong, disagreeable smell; the temperature of the water in the basin will be scarcely changed ; and its quantity will not be in the least degree augmented, though the boiling water will be diminished. This important difference in the results of the same experiment arises entirely from the introduction of the iron turnings, which will be found to have lost their metallic lustre, and to be coated with a black scaly substance.

This process appears to present, at first view, a perfect instance of annihilation. The water boiled in the closed vessel is diminished in quantity ; yet there has been no vapour produced, nor is the water existing, as water, in any other form. The only perceptible product of the operation is the formation of a noxious gas, bearing not the least resemblance to, but being, on the contrary, the very opposite of water in all its properties. In the first place it is about 11,500 times lighter than that fluid, and is even 14 times lighter than the air of the atmo-

sphere; it cannot, by any ordinary means, be condensed into a liquid; it is not only disagreeable to the organs of smell, but it is highly deleterious in its effects upon the human frame, if inhaled into the lungs; and, to make the distinction between this gas and water still more marked, it is one of the most inflammable substances in nature.

Is it possible for the properties of any two substances, therefore, to be more dissimilar than those of hydrogen gas and water? and must it not appear, to those who are ignorant of the composition of that fluid, extravagantly absurd to assert that hydrogen gas forms the principal component part of that fluid? We learn, however, from the science of chemistry that this is the fact; and that, in the experiment just adduced, the elements of which the boiling water is composed have passed through the process without undergoing even the slightest change, however great may be the difference between the compound and its separate elements.

To explain the nature of the change that the water has undergone, it will be necessary to premise that that fluid is composed of two elementary substances, called oxygen and hydrogen, in the proportion of eight parts by weight of the former, and one part of the latter. These substances are unknown to us in their simple states; and the only form in which they can be ob-

tained, unmixed with other bodies, is that of an invisible gas. As all gases, however, are supposed to owe their permanent elasticity to heat, with which their bases are presumed to be united; oxygen gas and hydrogen gas are, consequently, not simple substances. Oxygen and hydrogen gases possess a very strong affinity to each other, and, when placed in circumstances that favour their union, they quickly separate from the heat which retains them in a gaseous form, and the product of their union is water in its purest state. This combination is effected so rapidly, that the heat and light that were united with the bases of the two gases, on being liberated, become very perceptible; and when a mixture of hydrogen and oxygen gases is ignited, their rapid chemical action produces a loud explosion.

When oxygen and hydrogen are thus chemically combined, they cannot be separated by the most minute division of their particles—not even when assuming the form of an invisible vapour; and it is only when brought into contact with some other substance, to which the hydrogen or oxygen has a stronger affinity than they reciprocally possess, that the decomposition of the water can be effected. In the first arrangement of the previous experiment, therefore, before the introduction of the iron turnings into the tube, no separation of the elements of

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the vapour took place, because they did not come in contact with any substance to which the oxygen or hydrogen possessed greater attraction than they do to each other. By the introduction of the iron turnings, however, in the second arrangement, the oxygen of the heated vapour comes in contact with a substance to which it has superior attraction than it has to hydrogen, and it immediately leaves the hydrogen, to unite with the iron; and the hydrogen, having acquired sufficient heat, in passing through the red-hot tube, to assume a gaseous form, rises through the water as a permanently elastic fluid.

The black scales observable on the iron turnings are composed of the oxygen in its new combination with iron, in which state it forms what chemists term an *oxide* of iron. This oxide consists of twenty-eight parts by weight of oxygen and seventy-two parts of iron; and it will be found that the metal with which the oxygen has combined has increased in weight in exact proportion to the weight of the oxygen that was contained in the water that has been decomposed. The oxygen may be separated from the metal by bringing it in contact with some other substance to which it has a greater attraction than it possesses to the iron. It may be even made to unite again with the hydrogen, by subjecting it to a higher degree of heat; which increase of

temperature will have the effect of weakening the attraction of oxygen to the iron, and will render the reciprocal attractions between the hydrogen and oxygen stronger than the attraction between the latter and iron. If, for instance, the hydrogen gas, as it issues from the tube during the decomposition of water, were collected in a glass jar, and the oxidised iron turnings were carefully collected and placed within it, and the rays of the sun, concentrated in the focus of a powerful lens, were then directed upon the oxide, the oxygen would leave the iron to unite with the hydrogen, and would again become chemically combined with it in the form of water. The iron, on parting with the oxygen, would be restored to its metallic lustre, but its weight would be decreased. This experiment might be repeated again and again with the same quantity of water; and, if it could be performed with sufficient accuracy, the identical drops of water might be converted into steam, then decomposed, and, after their elements had assumed the opposite forms of a gas, and of a solid body in union with iron, they might be again united and reproduced in their original form, possessing their original properties, without one particle having been either lost or altered.

We shall adduce a few more examples of the conversion of solid bodies into aëriform invisible

gases, for the purpose of giving further illustration to this interesting branch of our subject.

If a known quantity of red lead (oxide of lead) be placed in a retort, and subjected to a strong heat, a quantity of gas will be generated, and the substance remaining in the retort will be found to be diminished in weight. If the gas be carefully collected in a proper apparatus, and weighed, the weight of the gas will correspond with that lost by the oxide. This invisible product, separated from the metal, is the same gas that constitutes the vital part of our atmosphere, and which forms the principal supporter of life and of combustion, though it is not cognisable by our senses. The base of this gas was before chemically combined with the lead, until the affinities of the oxygen and the metal were overcome by the agency of heat. The effect of the decomposition of the red oxide of lead has, therefore, been merely to produce a separation between the lead and the more subtile matter with which it was combined, and to liberate the oxygen in a form that will enable it to contribute towards the support of animal and vegetable creation.

All other combinations of oxygen with a metallic base may be decomposed by subjecting them to the action of bodies whose attraction to oxygen, or to the metal, is greater than that

which they reciprocally possess. In these cases, the metals may frequently be restored to their lustre and other metallic properties, which were lost in their oxidised state; and the oxygen will either enter into some other solid compound, or become an invisible elastic gas.

Again: if powdered marble be inserted in an earthenware retort, and intensely heated, a quantity of gas will be evolved; and this gas, if collected and weighed, will be found to correspond with the weight lost by the marble during its calcination. The gas produced in this experiment is called carbonic acid, or carbonic acid gas, and it possesses very different properties from either oxygen or hydrogen gases. It is considerably heavier, it has an acid taste, is devoid of smell, is fatal to animals, and extinguishes flame. By the abstraction of this gas the properties of the marble are materially changed; for it is then converted into caustic quicklime, capable of corroding animal substances, and possesses so strong an attraction to water, as to be able to absorb one third its weight of that fluid, and to retain it in a state of solidity.

If the caustic quicklime produced by this process, and the gas evolved from it, be brought into contact, without being heated, the lime will rapidly absorb the gas; the caustic properties of

the lime will be destroyed, it will be restored to the condition of powdered marble, and the gas will be again united with it in the form of a solid compound. This experiment, like the preceding ones, might, by possibility, be repeated for ever, without the loss or change, during the apparently destructive processes to which the lime is subjected, of any portion of the elements employed.

It would be foreign to our object to multiply illustrations to prove that solid bodies may be converted into permanently elastic aëriform fluids, without any diminution of their constituent elements. Those facts we have already noticed are sufficient to show that the process of rarefaction, even in those cases that appear most strongly to countenance the supposition of annihilation, merely produces a fresh arrangement of the particles of matter that compose the compound substances from which the gases are generated.

The phenomena that have been adverted to in this chapter present, we conceive, strong analogical evidence in support of the belief in a future life, and at the same time tend to remove the objections that have been advanced against the immortality of the soul.

One of the objections that has been urged against the probability of the existence of the soul after death is, the utter incapacity of the human faculties to comprehend by what means

the sentient principle, which during corporeal life is so intimately connected with the body, can exist in a separate and detached state, wanting the organs of perception, which seem to constitute the essence of life. This subject is one of the many that at present exceed the bounds of our comprehension; and we cannot, perhaps, expect that it should ever, by the utmost stretch of our reasoning powers, be made intelligible to our limited faculties. But when we ascertain, from the clearest possible evidence, that changes take place in nature nearly equally surprising with those that occur on death, without producing, in the former case, any destruction or change in the matter operated on; when we perceive the elementary particles of bodies reassuming, on decomposition, their simple states, or existing in new forms, the very opposite of those exhibited in their previous combinations; we cannot fail to observe in these phenomena an analogy to that more important separation of elements which, it is contended, occurs between the sentient principle of man and his corporeal frame, when the latter *ceases to live*. And, further, when we find that we are unable to entertain the most distant conception of the ultimate modes of operation by which these changes are effected—when the ulterior causes of the material processes that we are ourselves conducting are veiled in impenetrable obscurity,—we can

scarcely presume, in the consideration of the operations of those subtile or immaterial essences that are not cognisable to the senses, to erect our ignorance as the boundary of knowledge, and refuse to believe merely because we cannot understand.

CHAPTER V.

NATURAL DECOMPOSITION.

THE processes that have hitherto been noticed, as affording illustrations of the indestructibility of matter, in circumstances that present the most striking appearances of annihilation, have been derived from chemical action artificially induced. We shall, in this chapter, enter the grand laboratory of Nature, and draw from thence some additional evidence of the important truth that matter is indestructible.

The fallen leaves decaying on the ground, the mouldering ruins, the crumbling rocks, even the revolting spectacle of animal corruption, and every other variety of form in which the "all-destroying hand of Time" indicates decay and seeming annihilation, so far from really tending to weaken the position we are endeavouring to establish, may be brought forward to strengthen and support it.

In the first place, let us consider what takes place on the decomposition of vegetable matter.

The principal substances of which all vegetables are composed are, hydrogen, oxygen, and carbon. Though the different species of vege-

tables that have been discovered exceed 60,000, they are all composed of the same, or nearly the same, ingredients in different proportions. In some vegetable products, indeed, which possess very different properties, these proportions vary in so trifling a degree as to be scarcely distinguished by chemical analysis; and it is impossible to conceive how such important variations in the characters of compounds, so nearly approaching each other in their composition, can be produced. Starch, gum, and sugar, for instance, are vegetable products of very distinct characters; yet the analysis of each affords the same ingredients, and in proportions differing only in the most trifling degree.

In living vegetables the carbon is disseminated through the plant in all the ramifications of woody fibre, and it is also mixed with the hydrogen and oxygen in forming the juices that circulate through the leaves and branches. The decomposition of vegetable matter is caused by the separation of the oxygen, hydrogen, and carbon of which it is composed, from their existing combinations, and by their combining in different proportions with the same, or forming an union with other elements. Vegetable matter, when thus decomposed, becomes the nutriment of other plants, and contributes to the never-ending renovation of nature. When the genial warmth of summer, that enabled the noble oak

of the forest to secrete and raise its sap, is withdrawn, the tree sheds its leaves on the ground, where they decay and seem to perish; but, ere the returning warmth renews vegetation, those leaves are converted, by new combinations of their elements, into rich manure, and, probably, some portion of them will again contribute to the growth and support of their parent tree. When, in the course of years, the mighty oak itself falls to the earth, and the returning summer no longer brings with it renewed foliage to the decayed trunk, which lies gradually rotting on the ground, even then, the process of decay is but a more extended process of renovation; and when the action of the air shall have crumbled the timber into dust, it will form a portion of the soil, whence other trees will derive their nourishment.

Not one particle of the matter is lost in these changes. It is true, we cannot reproduce the plants in the same forms; it surpasses human skill to construct a tree, or to mould the smallest of its leaves; but the elementary substances of which they are composed can be proved to exist, undiminished and unaltered by decay and decomposition. We are enabled to ascertain that the elements continue unchanged, but of the manner in which they are again employed in the formation of other organised beings we are equally ignorant as we are of the modes by which the Author of Nature first called them

into existence; though of the fact that the disorganised elements remain uninjured, and are again employed in the organisation of other living beings, we possess the most conclusive evidence.

The decomposition of inorganised bodies by the hand of Time generally occupies too long a period to enable us to investigate the results of the process, with a view to ascertain whether any of the particles of matter have been lost; but, from a knowledge of the results attending experiments producing more rapid decomposition of the same matter, we may safely draw the conclusion that the decompositions of time, like those of art, are merely the effects of a different arrangement of the elementary particles composing the decayed bodies. When a piece of iron, for instance, is reduced to rust by the action of acids, we can determine, from the product of the decomposition, that the iron, instead of being destroyed, has its weight increased by the absorption of oxygen, and that not a particle of the metal has been lost by the process. If, then, we perceive a piece of iron corroded by long exposure to the atmosphere, and nearly eaten away with rust, we conclude that the same chemical attraction which was exerted to decompose the water of the acid, and caused the oxygen to unite with the iron, has been operating in a slower degree in decomposing the moisture

of the atmosphere, and in reducing the iron to an oxide, that has crumbled away, and left scarcely any of the iron remaining in its metallic state. In the latter, as in the former case, we infer that no portion of the metal has been lost; and we feel persuaded that if the crumbling particles of the corroded iron could be collected, and restored to a metallic state by the expulsion of the oxygen, they would be found to equal the original quantity of the metal before decomposition.

The decomposition of animal substances is attended with phenomena of a more disgusting character than those accompanying the decay of inanimate matter; but the evidence it affords, so far as it can be obtained, of the indestructibility of matter, is as conclusive in this apparently annihilating process as in any other branch of chemistry. Animal substances are, however, so extremely complicated in their compositions, and the affinities of the numerous compound substances that enter into their formation are so difficult to determine, that little is known respecting the chemical actions that regulate the functions of the body.

The principal ingredients of which animal matter is composed are ascertained to be oxygen, hydrogen, carbon, and nitrogen. Of the nature of the latter substance, we have, indeed, scarcely any satisfactory knowledge, though it forms one

of the principal constituent parts of many important substances, and, in the shape of gas, constitutes four fifths of the volume of atmospheric air. With these four elementary bodies various others are combined, and form a number of intricately compound products. In the human body there are secreted upwards of twenty different kinds of fluids, and the variety of solid substances of which it is formed are nearly equally numerous; therefore the difficulty of detecting the elements of each of these component parts, in their united decomposition, amounts almost to an impossibility: and the revolting nature of experiments with putrid matter, and the danger attending them, have also deterred chemists from investigating the subject. The products of animal decomposition, however, when carefully collected, are found to be equivalent in weight to the aggregate mass before putrefaction; and, so far as the inquiry has been pursued, we have the strongest reason to infer that the effect of the putrefactive process, like that of other chemical actions, is only to produce a change in the combinations of the elements on which it operates.

This change in animal matter appears to be caused, in the first instance, by the absorption of moisture from the atmosphere, and the decomposition of the moisture absorbed, by the aid of heat. The process of fermentation then com-

mences; the gelatinous and mucilaginous solids are resolved into fluids, and the multitudinous compounds are brought together in a condition favourable for the developement of the affinities of their respective elements. Various gases are evolved, some of which yield a most fœtid smell; and those portions only of the body remain that are not volatile, and they are dried up in a friable state, and crumble at the touch.

That moisture and heat are essential to the commencement of the putrefactive process, is ascertained from the circumstance that animal matter may be kept for an indefinite length of time when the temperature is reduced below the freezing point: and, again, when dead bodies are exposed to a high temperature, until all the animal fluids are expelled, no putrefaction takes place, and in this state they are frequently preserved for centuries. The effect of charcoal, salt, and other antiseptic substances, in counteracting putrefaction, may be attributed to their absorption of water, or oxygen, and thereby checking the decomposition of the moisture, that would otherwise induce putrefaction. The whole process of putrefactive fermentation is, indeed, strictly a chemical one; and, though we are unable to trace all its causes and effects, yet we know sufficient to enable us to infer that it resembles all other chemical actions, and merely resolves the elements of organic matter into

other compounds, whilst those elements remain, in every respect, unchanged and undiminished. We are thus enabled to obtain, even from the dissolution of the body itself, a corroboration of the evidence of the indestructibility of the elements of which it is composed.

When it is asserted that the decomposition of the animal frame after death produces only a new arrangement of the particles of matter, and that the elements composing the body remain unchanged and indestructible, it may be objected that the product of the decomposition bears no resemblance to the original body, and that, as the particles of matter cannot be again brought into the same combinations, and arranged in the same forms, the body is in fact destroyed. The organised form, it is true, is destroyed, and cannot be restored by human power. The simplest of organised beings are far too complicated in their arrangement, and too delicately and beautifully elaborate in their parts, for the ingenuity of man to equal; and they afford ample evidence of the supreme wisdom of the Author of Nature, by whose power they were formed, sustained, and are destroyed. But we know that the omniscient Creator of all things always operates by the simplest means, and is enabled to construct, out of a very few elements, an apparently unlimited number of compound substances. It is our present object

to show that none of those simple elements are destroyed by decomposition; and, though the difference between the compounds resulting from the putrefactive process, and those with which they were combined in the living body, is to us so extreme that their identity is entirely lost, yet, to the eye of Omniscience, the elements of matter must be visible in every hidden form; and we may presume that, in every change those elements undergo, they appear to Him the same.

CHAPTER VI.

COMBUSTION.

THE process of combustion seems pre-eminently to deserve the title of destructive, since there is no change we can conceive it possible for bodies to undergo that can produce so complete an apparent destruction of the matter acted on. There is not, however, any chemical process in which the elements of the substances brought into action can be more clearly shown to exist, after their metamorphoses, undiminished and unaltered, than in that of combustion; and we are hence enabled to derive from the most active and violent of chemical agents one of the strongest proofs that the elements of bodies are imperishable.

The chemists of the last century explained the phenomena of combustion by the supposition that all combustible bodies contain more or less of an inflammable property, to which they gave the name of *phlogiston*. They conceived phlogiston to be composed of light and heat united with some other matter; and that this fiery principle, on being disengaged from inflammable substances, became evident to the senses.

The lustre of metals was supposed to be caused by this imaginary internal fire mingled in their compositions; and the fact, that metals, after having been subjected to heat — and were consequently supposed to have parted with their phlogiston — lost at the same time their metallic splendour, tended to confirm this opinion. When, on further investigation, it was found that the *calces* of metals, as they were then termed, to which we now give the name of *oxides*, are heavier than the metals previous to combustion — instead of having lost weight by the process, as might have been expected, on the supposition that the metals had parted with a portion of their constituent ingredients — the advocates of the phlogistic theory attempted to overcome the difficulty by assuming that phlogiston was possessed of absolute levity, and that the abstraction of it from any body made that substance heavier than before, in consequence of the *loss of the lightness*, or of the anti-gravitating principle, of the phlogiston.

Ridiculous as this hypothesis now appears, it continued for a series of years to be considered as an established truth; and, even long after the experiments of Lavoisier and of Dr. Black had shown the fallacy of the reasoning on which it was founded, the supporters of the phlogistic theory of combustion, among the foremost of

whom was Dr. Priestley, continued stoutly to assert the correctness of their opinions.

Even at the present day, the scientific world is divided in opinion respecting the nature of heat and the phenomena of combustion. Some philosophers maintain that heat is an extremely subtile fluid, that is capable of insinuating itself between the ultimate atoms of all substances; whilst others conceive that heat and light have no existence as material bodies, and are merely the result of peculiar motions among the particles of matter: these motions of the molecules of matter are supposed to produce the sensations and effects of light and heat somewhat in the same manner as peculiar motions of the air are known to produce sound. It will not be necessary, however, to enter into a disquisition on the merits of these contending theories. The phenomena that will be adduced, in illustration of this branch of our subject, will admit of a clear explanation on either hypothesis; and the conclusions to be drawn from them, respecting the indestructibility of matter, are the same, whichever theory be adopted.

When a wax candle is lighted, and permitted to burn till it is consumed, scarcely a particle remains to indicate that the candle has ever been. The solid wax and the cotton of the wick have entirely disappeared; and their destruction seems to be so complete, that to assert that the

materials of which the candle was formed remain the same, and have not suffered the least diminution or change by the process, would be generally considered as evidence of a deranged intellect. That this is the fact, however, can be proved by the most satisfactory experiments. If, for instance, a small wax taper be ignited in a jar containing a known quantity of oxygen gas, it will burn with a very brilliant light, and the volume of gas will be diminished as the combustion proceeds, until either the taper be burnt out, or the oxygen gas be nearly consumed. Suppose the quantity of gas to have been sufficient to admit of the entire consumption of the taper, we should find, on weighing the product in the jar after combustion, that its weight exactly corresponded with that of the taper and of the oxygen gas before ignition, and that not one particle of matter had been lost.

We might carry the evidence still farther, and, by a careful analysis of the aqueous and carbonaceous products in the jar, we might ascertain that they agree precisely in properties, as well as in weight, with those elementary substances composing the taper and the gas. Wax, for instance, consists of carbon, hydrogen, and oxygen, in the proportion of about eighty parts by weight of carbon, twelve of hydrogen, and eight of oxygen, in every hundred parts. The cotton of the wick is composed of the same elementary sub-

stances, with a larger proportion of oxygen and a smaller quantity of carbon. The principal products of the combustion of the wax taper in oxygen gas will be found to consist of water and of carbonic acid gas; and in these substances we shall find united the elements of the taper and of the oxygen of the gas.

Water, as was stated in a former chapter, is a chemical compound of oxygen and hydrogen, and carbonic acid gas is a compound of oxygen and carbon; therefore the result of the combustion exhibits those three elementary substances, —carbon, hydrogen, and oxygen — which composed the wax taper, united into two distinct binary compounds, — the hydrogen with the oxygen, in the form of water; and the carbon with the oxygen, in the form of carbonic acid gas.

Combustion, indeed, differs from other chemical actions only in the degree of energy with which it is carried on; and depends, like other chemical changes, upon the reciprocal attractions exerted among the particles of matter brought into operation. In the combustion of the wax taper, the change produced is occasioned by the strong affinity subsisting between the hydrogen and carbon of the wax and the oxygen gas in the jar. When the hydrogen and carbon composing the wax have been heated to the point of inflammation — that is, when they have been rendered, by expansion and increase of

temperature, capable of exerting their attractions to oxygen in the most energetic manner — a rapid combination ensues, attended with the disengagement of heat and light; and their reciprocal attractions will continue to exert themselves in this manner, until the combustible body, or the supporter of combustion, be consumed.

The cause of the heat and light evolved during this process is ascribed, by those philosophers who imagine heat to be a subtile fluid pervading all bodies, to the condensation of the oxygen gas. All gases they conceive to be composed of some base, united with a large proportion of *caloric*, or the matter of heat, to which they owe their elasticity and gaseous form. During combustion, the oxygen that unites with the hydrogen of the wax, to form water, is thus condensed from a gas into a liquid; and the heat which was necessary to maintain the oxygen in an aëriform state is liberated, and becomes the object of sensation. Upon the other hypothesis of combustion, the heat and light are supposed to be generated by the rapid internal motions of the particles of bodies in arranging themselves in their new chemical combinations. According to both theories, however, combustion, so far from being the cause of chemical action, is supposed to be merely an adventitious phenomenon consequent upon rapid decomposition. Our present inquiry does not lead us to discuss the

respective merits of these theories. They both accord with the position, that the apparent destruction of matter by combustion is only a chemical change in the combinations of its ultimate molecules, and that not one atom is really destroyed by the process.

When combustion is carried on in atmospheric air, the effect produced is to abstract the oxygen from the nitrogen of the atmosphere; for the latter gas, not being a supporter of combustion, is, consequently, not affected by the process. The difference observable between combustion in pure oxygen gas and in atmospheric air is attributable to the greater rapidity with which the supply of oxygen is conveyed to the combustible in the former case than in the latter; for, as the atmospheric air is composed of only one fifth part of oxygen and four fifths of nitrogen, the combination of oxygen with the burning body proceeds but slowly in the air, compared with the intensity of its action when surrounded by the unadulterated oxygen gas. When the supply of oxygen is accelerated by a blast of air from a pair of bellows, as in a blacksmith's forge, the intensity of the heat is greatly increased, and the fire then burns almost as brilliantly as if surrounded by an atmosphere of pure oxygen gas.

The foregoing illustration of the phenomenon of combustion, and the explanation of its

causes, are applicable to all cases of common combustion. It may be advisable, however, to adduce a few additional instances of the effects of this species of chemical decomposition, for the purpose of impressing still more forcibly the important truth, that combustion is not, strictly speaking, a destructive process.

All substances possessing affinity to oxygen may be deemed combustible bodies; and, in proportion to the degree of their attraction to that elementary principle, they are more or less inflammable. Even metals are not exceptions to this rule, as may be proved by the following experiment:—Let a piece of fine music wire be twisted in a spiral form, and be inserted into a jar of oxygen gas, having previously attached a small portion of lighted tinder to the end of the wire: as soon as the tinder comes in contact with the gas it will burn with great brilliancy and inflame the wire, which will continue to burn rapidly and vividly until the whole of it is consumed. The product of the combustion will be small globules of the black oxide of iron, and the metal will have increased in weight in exact proportion to the weight of the oxygen gas consumed in the experiment.

The attraction of some of the newly discovered metals to oxygen exceeds that subsisting between oxygen and any other known substances; and those metals are consequently the

most inflammable bodies with which we are acquainted. The metal potassium possesses so powerful an attraction for oxygen as to abstract it from all substances. When potassium is placed upon water, it instantly decomposes that liquid, and burns upon its surface. This evolution of heat is produced by the rapid combination of the potassium with the oxygen of the water, and the metal then becomes an oxide of potassium; in which form it is commonly known as potass. Potassium will even abstract oxygen from water when the latter is frozen, and will exhibit, during its combustion, the extraordinary phenomenon of ice on fire.

The inflammation of carburetted hydrogen gas, with which the streets and shops of our principal towns are now illuminated, differs essentially in its apparent results from the combustion of solid bodies. Carburetted hydrogen gas is invisible, and is not perceptible to the touch; the air, that supports its combustion, is also not cognizable to the senses of sight or feeling, and yet the combustion of these invisible bodies produces a large quantity of liquid and solid matter (water and soot), independently of the invisible carbonic acid gas, which is also generated during the process. In this case, therefore, combustion exhibits itself as a creative instead of as a destructive agent, though, in point of fact, the same causes, followed by si-

milar results, operate in this as in every other instance of combustion. For the elucidation of the causes of this phenomenon, it must be borne in mind that carburetted hydrogen gas is a compound of hydrogen and carbon in an invisible elastic form ; and, during inflammation, the hydrogen and carbon of the gas unite with the oxygen of the air in precisely the same manner as the hydrogen and carbon of solid combustible bodies — the hydrogen gas forming water by its union with the oxygen, and the carbon forming carbonic acid gas and soot. The production of soot during the combination is to be attributed to the imperfect combustion of the carbon ; — only a portion of it being enabled to assume a gaseous form, either owing to the want of an adequate supply of oxygen, or to the absence of sufficient heat.

In every form, and under every circumstance that combustion takes place, the process will uniformly be found, as in the illustrations we have adduced, to be caused entirely by the active decomposition of the combustible body. As decomposition is, so far as we are able to discover, only the result of new combinations between the particles of bodies, the process of combustion will, therefore, resolve itself into the rapid disengagement of the elementary particles of bodies from their original compounds, and their re-arrangement, in different forms, with

other elements. The heat emitted during the process, so far from causing the destruction of these elementary particles, is itself generated, or brought into action, by the operation of the respective affinities which these particles possess one towards the other. The heat evolved during combustion is not produced until *after* the new combinations are formed, and it is merely the *effect* of which these energetic combinations are the cause.

To illustrate this position, let us for a moment consider more closely the successive stages of the process of combustion, and we shall then be convinced that the production of heat is *subsequent* to the chemical action that takes place between the inflammable body and the supporter of combustion. When a combustible is ignited, the hydrogen and carbon in immediate contact with the flame are rendered gaseous by the heat, and are thereby adapted to enter into combination with the oxygen of the surrounding air. This combination, in consequence of the force of their respective attractions, is so energetic as to generate, or liberate, a quantity of light and heat. The heat thus evolved is sufficient to bring those portions of the combustible, next in contact, into a proper condition for combining with more oxygen, and an additional quantity of heat is thus liberated; this also acting on succeeding portions, in a similar man-

ner, and those again on others, the process proceeds uninterruptedly until the whole of the combustible be consumed, or the supporter of combustion be exhausted. Each successive combination of the elements of the combustible body with the oxygen, it will be perceived, produces the heat that facilitates the union of the portion immediately following; and the heat produced is the result of the immediately preceding combination with oxygen, and is not evolved until that combination has been effected. So far as relates to the antecedent particles of matter, that have been united with the oxygen, the process is concluded as soon as the union of the elements takes place, from the activity of which the heat arises; and if we could divide the continuous process of combustion into distinct operations, limited to each separate combination of the particles of the combustible with oxygen, the heat given out would appear to be merely an adjunct to, and a consequence of, the phenomenon, entirely unconnected with its cause, of which it is only the necessary effect.

When we thus view combustion as the effect, and not as the cause, of rapid decomposition, fire loses all its terror as a destructive agent, and serves rather to indicate the rapidity with which new creations, consequent upon different combinations of the elements of bodies, are called

into being, than to denote the destruction of matter.

Independently of the proof which this view of the agency of combustion affords of the imperishable nature of all material substance, it is also valuable as presenting an answer to those objections against a future life that are founded on the supposed improbability of the sentient principle surviving the system of organisation by which it is developed. If we were unable to ascertain the nature of the changes effected by combustion, and were obliged to form our opinions solely from external appearances, the balance of probabilities between the indestructibility of matter by fire, and the indestructibility of the soul by death would, we conceive, be greatly in favour of the latter. The continued existence of the particles of a combustible substance that has been, apparently, entirely consumed by fire, seems so directly opposed to the evidence of our senses, that unless we possessed the most ample proofs of the fact, it might well be considered impossible. In the presumed existence of the soul after the dissolution of the body, on the contrary, the internal evidence is in its favour; for every one feels conscious that mind is something distinct from the animal frame, and the natural inference consequently is, that the mind is capable of a separate existence. If our faculties were enabled to com-

prehend the nature of mind, we should, there is no doubt, trace its existence, after the destruction of the material organisation with which it is connected, in a manner equally certain, as we are able to ascertain the indestructibility of combustibles by fire; but the limited extent of our intellectual faculties prevents the investigation of such subtile essences. We can only pursue the inquiry by analogy and induction from the actions of matter, yet the evidence thus obtained may be so strong as almost to equal that of positive proof. And when we find that facts in physical science which can be clearly demonstrated, appear to the unenlightened to be impossibilities, even those who possess the most penetrating and well-stored minds should be cautious how they express doubts respecting the possibility or probability of the operations of Nature; for the highest attainment of human knowledge, when compared with Omniscience, must be infinitely below the ignorance of the most illiterate, in comparison with the acquirements of the greatest philosophers.

CHAPTER VII.

GENERAL SUMMARY.

THE important truth, that matter is indestructible, has been illustrated, in the preceding chapters, by a variety of examples derived from those chemical processes in which the substances operated on are apparently destroyed. We commenced with the most simple form of chemical action, and traced the existence of the elements of matter through the varied combinations they undergo in solution, evaporation, rarefaction, decomposition, and combustion; and, in each example of these respective processes, the ultimate particles of matter were shown to be unaltered by the changes in their outward forms, and not to be in the least degree diminished even by that most energetic of all chemical actions, which is accompanied by the phenomena of combustion.

Each particular instance of the effects of chemical action that has been noticed might be adduced as analogical evidence that matter is not destroyed by any other modes in which the same processes may operate, even were each illustration unsupported by other experiments. We possess, however, abundance of corrobora-

tive proofs, founded on experience, in support of the position that none of the processes we have alluded to are destructive. The deductions from experience are considered more satisfactory than any evidence short of that derived from intuition; and we rely with the greatest confidence upon the recurrence of the same results that experience has taught us have, under precisely similar circumstances, previously taken place. When, for instance, we have satisfactorily ascertained that in the solution of a lump of sugar not one particle of it is lost, we conclude, by reasoning from experience, that in all subsequent similar solutions the saccharine matter will remain unchanged and undiminished; and though we may not know the fact from actual experiment, we entertain no doubt on the subject when we see other lumps of sugar dissolved. If, indeed, mankind could not depend upon the results of experience, they would continually be in a state of the greatest uncertainty, as they would be doubtful respecting the consequences of the most simple actions; but we learn, by seeing the same effects always resulting as natural consequences from the same causes, to place the most implicit reliance upon that evidence.

Experience, in the strict application of the term, comprises only those facts which have previously come within our observation; and in

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this sense the evidence of experience must necessarily be extremely limited. In the more general acceptation of the term, however, it is applied to those actions which on examination will be found to depend for their verification on analogy alone. We infer from the resemblances which unknown substances bear to others which we have observed to obey a certain law, that they are bodies of the same kind, and that the untried substances also will obey that law. We are usually said to obtain this knowledge from experience; but, strictly speaking, it is founded on analogy; inasmuch as the qualities and chemical affinities of the new bodies operated on are known only by their resemblances to others on which experiment has been made. When, for instance, I strike my hand against the table on which I write, I know from experience of the most intimate kind that it will meet with resistance: when I relax my hold of my pen I know with equal certainty it will fall. But though I feel absolutely certain that the table on which I am writing will offer resistance to my hand, I cannot be supposed to be equally certain that a table which I see for the first time will offer the same resistance; and when some solid body previously unknown is placed in my hand, I can have no knowledge, from actual experience, whether it will rise in the air or fall to the ground, when I relax my

hold. The experience I have had, however, respecting other tables and other solid bodies, teaches me that they do resist my hand, and that they are attracted to the earth by the power of gravitation; and I conclude that the untouched table and the unknown substance will be equally substantial, and will obey the same laws. — I am led to this conclusion respecting these unknown substances, because the one agrees in appearance and the other in solidity, with those known bodies which have been invariably found to exhibit those properties which I expect to find them possess; and I have so firm an impression in my mind of the correctness of this inference, that I should conceive the opposite opinion to be in the highest degree absurd. The deductions in these cases are, however, only founded on close analogy.

This method of determining the properties of, and of drawing conclusions respecting, things unknown by their resemblances to things that are known, is necessarily depended upon in all branches of human knowledge; and when the analogy is clear, and is supported by observation of the laws which regulate similar bodies, the deductions from it are as satisfactory as any evidence we can require.

In the instances just adduced, the analogies are very closely allied to the evidence of experience; but until the table was touched and the

unknown body fell to the ground, strict experience was wanting to confirm the belief that the table would offer resistance to the hand and that the body would gravitate; and the deductions founded on their resemblance to other bodies was merely drawn from analogy.

Again: the dependence to be placed upon the evidence of what may be termed strict experience varies in proportion to our knowledge of the causes that produce the expected results. Though I am absolutely certain that the table will resist my hand, I cannot be said to be equally certain that the sun will rise on the morrow, or that the tides will continue to ebb and flow; for the causes of those phenomena are too imperfectly known, and the bodies operated on are too remote, to enable me to be absolutely certain that they will constantly take place. I take for granted, however, that what has occurred every day without intermission since the creation of the world will not fail to occur to-morrow, and I depend upon the recurrence of those events with nearly as little doubt as I entertain respecting the resistance of the table or the gravitation of the pen. There must, however, always be somewhat less of absolute certainty attending the evidence of experience when applied to future events which depend upon remote causes, than when applied to facts which come within the scope of our knowledge.

We may conceive it possible, without supposing any violent interruption of the system of the universe, for the sun to be deprived of the power of communicating light, or that the inclination of the axis of the earth to the plane of its orbit might be increased; but we cannot conceive it possible for the table on which we are leaning suddenly to lose its power of resistance to the hand, nor for the pen to do otherwise than obey the power of gravitation, unless upheld by a miracle.

Though the deductions depending solely on the continued succession of events are not so positively to be relied on as those derived from the operation of known causes, yet both species of evidence are founded on strict experience, and neither of them admits a rational doubt of its correctness. The deductions from well-supported analogy also, when confirmed by experience, become nearly, if not quite as satisfactory as those drawn from experience itself, and seem indeed to be little removed from absolute certainty.

It has been thought desirable to introduce the foregoing exemplification of the relation subsisting between the evidence of well-founded analogy and that of experience, for the purpose of showing that the testimony on which mankind universally rely with the most perfect assurance has its foundation on analogical assumptions.

The false conclusions that have been often drawn from imperfect or remote analogies, have tended to throw discredit upon arguments so founded; but if we discard analogy as a foundation of human judgment, we must be content to abandon the greatest portion of our physical knowledge, and the succeeding illustrations will show, that when this mode of arriving at truth is cautiously used, the conclusions to be drawn from it may be, and are, relied upon with certainty scarcely inferior to that of positive proof.

When we infer that the results of the solution of one lump of sugar are the same as those attending all other solutions of sugar in the same solvent, under similar circumstances, we proceed upon the clearest evidence it is possible to obtain — that of experience. If we were not acquainted with the results attending the solution of any other substance than sugar, we might, perhaps, infer, — from analogy, — as no particle of sugar when dissolved is lost by the process, that in all solutions the substance dissolved is not destroyed, but is only suspended in the solvent. The analogy in this case, however, if unsupported, could not be alone adduced as evidence of this general effect of solution. If, however, we found, after analyzing the products of three or four other solutions, that the same results occurred, the inference drawn from the analogy would assume a character of great probability.

When, on further investigation, we found that during every solution which we are enabled to analyse, the particles of matter in the body dissolved have merely entered into different combinations, and are not destroyed, or even changed in their properties, the general conclusion deduced from these facts, viz. that matter is never destroyed or altered by any kind of solution, acquires a degree of certainty little short of that drawn from direct experience.

Having thus acquired a satisfactory knowledge of the fact that matter is not destroyed by solution, we might proceed to infer, that as in this apparently destructive chemical action, the elements of matter only undergo a new combination, therefore in all other chemical actions the elementary particles of matter are merely combined in different forms, and are not destroyed. This analogical inference might be drawn from the process of solution alone, but it would be too general a deduction from one species of chemical action to be confidently relied on. When, however, we perceived, on examining the results of other chemical processes, that even the most apparently destructive of them are really inoperative to effect the least diminution in the particles of matter, we should be warranted, by this accumulated experience bearing upon the point, in concluding that such an inference is correct. When, for instance,

it is ascertained, that in every known form of solution, of evaporation, of rarefaction, of decomposition, and even of combustion, the elements of matter are not changed or diminished; — that no particle of the matter acted on suffers annihilation — and that by no known process whatever can matter be destroyed; — this accumulated evidence, derived from experience, gives so strong a corroboration to the analogy, that the proof of the indestructibility of all matter becomes almost as well established as any truth can be of which we have not absolute demonstration.

The same important truth may be arrived at in another manner. It is known that all chemical actions we are acquainted with are merely the results of different states of chemical affinity, and that the decomposition and separation of the elements of bodies are effected only by the formation of new combinations. The processes of chemistry, therefore, which we are in the habit of considering as agents in the destruction of bodies, are but the passive effects of the operation of chemical attraction, which has caused the particles of matter to combine, either with different substances or with different proportions of the same.

Taking this view of the subject, then, it will be seen that the several processes selected for illustration in the preceding chapters, as exhibiting the most striking instances of the apparent

destruction of matter, are only subsequent effects induced by the operation of chemical attraction. The phenomena of solution are the results of the affinity subsisting between the liquid and the substance dissolved, — evaporation is the effect of similar attractions between the liquid evaporated and the atmosphere, — rarefaction, of that subsisting between the rarefied body and heat, — decomposition is the effect of various chemical affinities, which separate the parts of bodies from their original compounds to form others of a different kind, — and even combustion has been shown, in the preceding chapter, to be only the result of similar affinities exerted energetically between the elements of the combustible bodies and the supporters of combustion.

If, then, experience teaches that the operations usually considered the most destructive do not in fact destroy one particle of matter; and if we learn, also, that those operations themselves are nothing more than the effects of new combinations, and are entirely dependent upon the operation of those combinations; we receive additional evidence of the most conclusive nature to confirm the former deductions from analogy. We thus perceive that it would be impossible for those processes which appear to change the forms of bodies to destroy the ultimate particles of matter, because the processes themselves are

only effects consequent on the changes that have already taken place, and merely indicate that the new combinations have been completed.

We are not acquainted with any physical process or operation of Nature that can annihilate matter: experience teaches us that matter is imperishable; and we cannot form the least conception of the possibility of its annihilation. We are bound, then, to believe from an accumulation of evidence so strong as to be completely irresistible, that the elements of matter which have once been created can only be annihilated by the direct interposition of the Omnipotent Power that brought it into being.

Having thus arrived, by different modes of reasoning, at the important truth that all matter is indestructible, excepting by the direct interposition of the Power that created it; the next consideration is the application of this truth, to prove the imperishable nature of the sentient principle in man.

In this branch of our inquiry we cannot — owing to the limited extent of our faculties, and our complete ignorance of the condition of the mind after death — be aided by direct experience. Our faculties are, indeed, completely baffled when we attempt to investigate the subject; and as it seems impossible for us to attain a knowledge of the nature and properties of our own mind, even when we are acting under its

impulse, we can have but little expectation of ascertaining the nature of the minds of others: and as the sentient principle is so extremely subtile as to evade all attempts to investigate its nature when united with the corporeal substance which it animates, and renders capable of performing the functions of vitality, we can scarcely hope to be able to penetrate the mystery of its being, when it is separated from the body, and no perceptible trace of its existence remains. Being deprived, then, by our incapacity to comprehend so subtile an essence, from gaining any positive evidence relative to the nature of the human mind, or from being able to assist our inquiries respecting its existence in a separate state from the body by the results of experience, we are obliged to have recourse to the next best evidence we can obtain, which is that of analogy. If, however, the analogical evidence be strengthened by a number of facts derived from experience, tending, by their separate corroborative testimonies, to confirm the belief of a future existence of the sentient being, the effect of this combined evidence bearing upon the point will be nearly as conclusive as that of direct proof. It will bear, in short, the same relation in the investigation of truth that circumstantial evidence bears to that of positive testimony: the latter is, indeed, more direct, but circumstantial evidence may be not less satisfactory.

In the progress of our inquiries we trust we shall be able to present a mass of evidence of this description, tending to support, in the strongest manner, the position which it is our object to establish. One important link in this chain of evidence is the truth arrived at in the foregoing investigations. Indeed we might, as has been already observed, infer, with the greatest probability of correctness, from that truth alone, that the soul is indestructible. For if matter, which is continually undergoing apparent and most striking changes, be imperishable, we cannot reasonably suppose that the mind, which controls all the actions of matter with which it is incorporated, is of a more perishable nature than the grosser particles that are subservient to its will. The numerous instances, also, with which we are acquainted, of the continued existence of matter in a more subtile form, and therefore inappreciable by our senses, after it has apparently been annihilated, afford strong emblematical analogy to the existence of the soul after its separation from the body.

We can scarcely conceive a greater change than that which takes place on the decomposition of water, and the conversion of its tasteless and salubrious liquid particles into an inflammable, invisible, and noxious gas, and into a solid body combined with iron. No annihilation could appear to be more complete than that of the

water in this process to those who are ignorant of the nature of the phenomenon: and yet, when that is known, it affords one of the strongest proofs of the indestructibility of matter. The changes that occur on death are not greater, nor do they present a more decided appearance of annihilation, than the decomposition of water. The decomposition of animal bodies indeed exhibits, not only the destruction of the system of organisation, but of the matter organised: nevertheless, not one particle is lost throughout the complicated process; and if we were capable of investigating the mental processes consequent on the dissolution of the body, we can scarcely doubt that the sentient principle would be found to be as imperishable and unchangeable as the matter with which it was united.

Our dense faculties will not enable us to comprehend the nature of immaterial being; and even those material substances that assume a subtile form, surpass the bounds of our comprehension. The power of gravitation, for instance, is supposed to be caused by a material agent; but of its nature or modes of operation we are totally ignorant. We know, however, that it exists, and that it has continued, since the creation of the world, to exert the same influence over grosser matter in all its combinations, decays, and apparent dissolutions. We have a firm conviction that the power of gravitation is of equal,

if not of superior, duration to the matter which it controls; and we know that its force is not diminished by the complete decomposition of the substances on which it operates. The same observations would apply to heat, light, electricity, magnetism, and chemical attraction; of the nature of which we know nothing, though of their existence we have continual proof. When we combine these facts, relative to the indestructibility of matter, and when we consider our incompetency to investigate immaterial essences, we shall have strong grounds for believing that mind is as imperishable as material substance; and we shall see the futility of those objections raised to the separate existence of the soul, merely on the ground of such a state of separation being incomprehensible. When, for instance, we perceive that matter cannot be destroyed — that the more subtile properties of matter exercise their power over the grosser particles undisturbed by the changes and separations among the particles themselves — that these changes and separations seem fully as great, and are as incomprehensible, to those not initiated into the mysteries of science, as the supposed separate existence of the soul from the body must, from the incapacity of the human intellect, be to the wisest of mankind — when we perceive that this incapacity alone prevents our arriving at the same truth, respecting the sentient principle,

which we have attained respecting the indestructibility of material substances — we are led, by a powerful combination of the clearest analogies, to the conclusion, that the sentient principle is as imperishable as the apparently frail substance in which it is enveloped: and this deduction from analogical evidence derives strong confirmation from the fact, that in all cases wherein we are enabled to pursue the inquiry to a satisfactory termination, the results are the same as those we infer to be the case with the mind, which we cannot analyse. If, therefore, we possessed no other natural evidence in support of a belief in a future life, the analogical argument founded upon the indestructibility of matter would of itself, we contend, be sufficient to afford strong presumptive proof of its correctness.

The argument in favour of a future life, afforded by the indestructibility of matter, has been forcibly expressed by an able writer in the following words: — "We have the evidence of experience that nothing is ever suffered to perish but particular systems; which perish only *as systems*, by a decomposition of their parts. A being which, like the soul, has no parts, can suffer no decomposition; and therefore, if it perish, it must perish by annihilation. But of annihilation there has not hitherto been a single instance; nor can we look for a single instance

without supposing the volitions of God to partake of that unsteadiness which is characteristic of man. Corporeal systems, when they have served their purpose, are, indeed, resolved into their component parts; but the matter of which they are composed, so far from being lost, becomes the matter of *other systems* in endless succession. Analogy, therefore, leads us to conclude, that when the human body is dissolved, the immaterial principle by which it was animated continues to think and act, either in a state of separation from all body, or in some material vehicle, to which it is intimately united, and which goes off with it at death; or else that it is preserved by the Father of Spirits, for the purpose of animating a body in some future state. When we consider the different states through which that living and thinking *individual* which each man calls himself, goes, from the moment it first animates an embryo in the womb, to the dissolution of the man of fourscore; and when we reflect, likewise, on the wisdom and immutability of God, together with the various dissolutions of corporeal systems, in which we know that a single atom of matter has never been lost; the presumption is certainly strong, that the soul shall subsist after the dissolution of the body. But when we take into consideration the *moral* attributes of God — His justice and goodness, together with the unequal distri-

bution of happiness and misery in the present world, this presumption from analogy amounts to a *complete moral proof* that there will be a future state of rewards and punishments."

The natural evidence of a future life does not, however, rest upon the indestructibility of matter alone. That forms only one link—though an important one — in the chain. In the subsequent portions of this volume our investigations will be directed to other phenomena bearing upon the same point; and the accumulation of evidence confirmatory of the deduction from the imperishable nature of matter will, we trust, be found so strong as to remove all reasonable doubt of its truth.

PART II.

THE PROPERTIES OF MATTER.

CHAPTER VIII.

PRELIMINARY OBSERVATIONS.

When treating of matter in the preceding part of our subject, we were obliged to consider it as being invested with certain properties, or qualities, which are inherent in all known material forms; but matter, when viewed in the abstract, has relation only to solidity and extension. It is this abstract idea of entity to which philosophers refer when speaking simply of matter. This substance is presumed to possess no active properties, but to be merely endued with solidity, and the capacity of occupying a certain portion of space. Its ultimate atoms are supposed to be infinitely minute, but nevertheless to be solid and impenetrable.

Of matter in the abstract, however, we can form no defined idea, and all our notions of material bodies are associated with peculiar qualities that are superadded to mere solidity and magnitude. Every substance that surrounds us is a compound of several of these qualities, united

with certain portions of matter; and when we have pursued the analysis of any body to the ultimate limits that our chemical knowledge will admit, and have arrived at what we consider to be its simple elements, those elementary substances will be found to be endued with several qualities in addition to those appertaining to abstract matter. The metals, for instance, defy the power of chemical analysis to decompose them; and they are consequently regarded as simple uncompounded elements. They exhibit many properties, however, distinct from mere solidity and magnitude. Most of this class of bodies possess the power of decomposing and of reflecting the rays of light,—the power of cohesive attraction, by which their particles are held firmly together,—of chemical attraction, by which they are disposed to enter into combination with other bodies,—the attraction of gravitation, by which they are drawn to the earth,—the power of conducting heat and electricity,—and, in the case of iron, of becoming the agent of magnetism. Each of the metals, also, though agreeing in their general characteristics, possesses these properties in different degrees and has peculiar qualities that distinguish it from the rest. Now these properties, in which nearly all other elementary bodies participate in a greater or less degree, are energetic agents which excite the inert masses of matter to action, and thereby

cause most of the changes that we perceive continually taking place in the material world. The property of *inertia*, which is supposed to belong to all abstract matter, is by these means overcome; and the active qualities inherent in matter are thus constantly exerting a controlling power over the material *substratum* to which they are attached. Whether these properties of matter be themselves composed of subtile material atoms, or whether they consist of immaterial essences acting on matter, it is not within our province to inquire. Our object will be to show that these agents are distinct from what is abstractedly considered to be matter; that they are subtile active properties, that control and modify the solid materials with which they are connected; and that these agents are equally indestructible with the matter on which they operate. If these facts can be established, the inferences to be drawn from them will, it is conceived, tend strongly to confirm the evidence already advanced in support of our general proposition; and the considerations that will present themselves in the course of our inquiries will assist in an important degree to remove those objections that are founded on the impossibility of comprehending a state of existence after death.

When we adduce the indestructibility of matter as evidence of the indestructibility of mind, we draw a direct inference from corresponding

appearances; and the conclusion we arrive at is founded, in a great measure, upon the observed uniform agreement of the laws of nature:— those laws having been found by experience to be opposed to the destruction of material substance, we conclude they will be equally opposed to the destruction of immaterial essence. There is, however, another argument to be drawn from analogy less direct than the former; which, instead of tending to prove the great probability of the deductions relative to unknown properties from those properties that are known, tends principally to show that the inferences are at least not inconsistent with the ordinary operations of nature.

This mode of reasoning indirectly from analogy may be advantageously applied to overcome those objections that are raised to the natural evidence of a future life, from the supposed impossibility of the soul existing in a separate state from the body.

To those persons who conceive that objections founded only on the incapacity of man to comprehend the nature of the human mind have any weight, it will be of importance to point out, more fully than has hitherto been done, some of the numerous instances in which our intellects are completely baffled in attempting to comprehend the most ordinary phenomena. When the mind is sufficiently impressed with its own in-

sufficiency to penetrate the secrets of nature — even when the objects investigated are appreciable by our senses — the absurdity of presuming to circumscribe the operations of the Omnipotent Creator respecting immaterial essences — of the nature of which we can form no conception — seems to be exceeded only by its impiety. An inquiry, therefore, directed to the investigation of the more subtile properties of matter, may be very advantageously undertaken, were it with no other view than to exhibit the utter inadequacy of the intellectual powers of man to understand the ultimate causes of even the simplest operations of nature.

In pursuing this inquiry, however, we shall be able to add materially to the direct analogical evidence in favour of a future state of existence. When, for instance, we find certain properties inherent in matter, which properties, though generally considered to be themselves material, are at the same time so subtile as to elude all attempts to ascertain their natures;—when we find, as in the cases of chemical attraction and of gravitation, that these properties are not destroyed nor affected by the decomposition of the bodies in which they are manifested, but that they continue inseparable from them in all changes of form;—we shall surely be justified in considering this union of subtile active properties with inert matter as strongly analogous

to the union of the sentient principle with a material body; and the continued existence of those subtile properties of matter, after the forms with which they were combined are completely dissipated, to present a close symbolical analogy to the continued existence of the soul after the dissolution of the material system of organisation with which it was united.

CHAPTER IX.

LIGHT.

LIGHT is the intermediate agent of vision. Were it not for the presence of this agent the organs of sight, which are so curiously and beautifully contrived for the reception of impressions from external objects, would be entirely useless; our knowledge of created things would be limited to the extent of the senses of hearing and of touch; and the inhabitants of the world would have to grope their way in impenetrable darkness, and in the profoundest ignorance of other worlds and systems. It is by the agency of light, acting upon the eye, and transferred by the internal mechanism of that organ to the brain, that we are furnished with the principal inlets of knowledge; and that property of matter has, therefore, afforded an interesting object of research to scientific inquirers of every age. Though they have succeeded in attaining some knowledge of the laws by which light is regulated, yet of the nature of light itself we still know nothing. Indeed, respecting the absolute nature of light there has not been even any conjecture

formed, — and with regard to its mode of operation philosophers are not agreed.

The two theories that have been most generally received, as affording the best explanation of the mode by which light acts upon the visual organs, are the theories of emission and of undulation. According to the former hypothesis, light consists of extremely minute material particles, that are supposed to be emitted from the luminous body with immense velocity; and these particles, being refracted by the eye, and forming an image of the luminous object on the retina, are supposed to convey to the mind an idea of its form and colour. The undulatory theory supposes that light is an extremely subtile fluid pervading all space, and that the sensation of sight is produced by an undulating motion communicated to this fluid by the luminous body. This motion, it is supposed, acts upon the retina and the optic nerve, and, it is presumed, occasions an impression of the object on the brain, in a similar manner to the communication of sound by undulations of the air.

The latter theory appears to be the one most generally adopted at the present day, and it is found best to correspond with the known phenomena of light; but it will be observed, that neither of these theories attempts to explain the nature of light itself. To say that it consists of

extremely minute particles impelled with great velocity — or that it consists of an all-pervading subtile fluid, which only becomes sensible to sight when agitated by the luminous body — conveys not the least idea of light; for of the nature of those particles, or of that fluid, whose rapid concussions on the retina, or whose vibrations, are supposed to produce the effect of giving light, we are still as ignorant as ever.

It must be borne in mind, that to the ignorance of the nature of light to which we have alluded, is to be added our profound ignorance of the mode by which the sense of sight is produced in the brain. For, admitting that it would be possible to comprehend the nature of light and its mode of operation upon the eye, the still more difficult problem would remain to be solved — by what means is the sense of sight produced in the mind by the mechanism of the eye?

Though we are thus ignorant of the nature of light, considerable advance has been made in the investigation of its properties, and of those laws by which it is regulated. The knowledge we have thus acquired presents such a number of astonishing results that, were they not proved by the most accurate experiments, they might reasonably be considered almost impossible.

In the first place, the immense velocity with which light travels, or is communicated, far surpasses human comprehension. The distance

from the sun to the earth — upwards of ninety-five millions of miles — is traversed within the lapse of eight minutes, which is a rate of speed 2,300,000 times faster than that of a ball fired from a cannon, and would carry a ball projected with that velocity nine times round the earth in a second of time. The extraordinary power which dense transparent media possess of bending, or refracting, the rays from their direct course, is another wonderful property belonging to light that we cannot clearly understand. So essential, however, is this property, to give effect to the purpose for which light was created, that, unless it were capable of refraction, light would be useless as an agent of vision, as it is by this means that the images of objects are brought to a focus on the retina of the eye.— The composition of light, again, affords another subject for astonishment and admiration. The discovery by Sir Isaac Newton that the white light from the sun is composed of all the primary colours, and that when all those colours are united they become colourless, seems so entirely opposed to all our ideas of what is probable, that it might completely stagger belief, were it not established by the clearest demonstrative evidence. The decomposition of light by most visible substances, the absorption of some of the coloured rays, and the reflection of others, by which means the different colours of bodies are pro-

duced, are also phenomena connected with light, the operations of which are entirely unknown. Recent discoveries relative to what are termed the "interference," the "diffraction," and the "polarisation" of light, have disclosed new and interesting properties in this subtile fluid that were previously unsuspected; and the extension of our knowledge seems only to render our incapacity to comprehend the nature of that subtile agent the more apparent.

If the rapidity of the communication of light were only conjectural, or were the fact supported by less substantial evidence, objectors might be found ready to prove the impossibility of any particles of matter being impelled with so great a velocity, without communicating motion to other particles of matter with which they come in contact. We might be told, that as light is presumed to be impelled or communicated at a rate 2,300,000 times faster than that of a cannon ball, it would require to be set in motion by a force proportionably greater than that which impels a ball from the mouth of a cannon; and the supposition of such an immense impulse being given to matter by the flame of a candle, or by the smallest visible spark, might be represented as being opposed to the dictates of common sense, and contrary to the experience of the action of flame upon all other matter.

What overwhelming objections would also be

raised, and what a fine field for sarcasm would be opened to the sceptics, if the phenomena respecting the general diffusion of light were founded on less than demonstrative proof! As every visible object must send rays of light from all parts of its surface in every direction, what innumerable crossings of rays must occur before they enter the eye! and as each ray of light must, according to our notions of the action of all moving bodies, on coming into contact obstruct and influence the motions of the other rays that it crosses, it is impossible to conceive how any ray of light should, under such circumstances, be transmitted to the eye without having its course altered, or without being mingled with the other rays that it meets with in its progress. When two candles, for instance, are burning in the same room, each flame must, we know, be sending out rays of light to every part of the surrounding walls with a velocity two millions of times swifter than that of a cannon ball. The rays must, consequently, cross each other in millions of places; and how ludicrously absurd it would be considered, and how contrary to the established modes of philosophising, to suppose that the particles of the same fluid could strike against each other with such velocity without any alteration in the direction of their motions, or without being in any way apparently affected by these continued concussions.

But if such an hypothesis would seem inconsistent with the laws of motion, when the rays are considered as proceeding from only two luminous points, how infinitely greater would that inconsistency appear, when the luminous bodies are multiplied, and when we consider that every object we behold is sending forth radiating rays, which must meet with and cross each other at every point of their progress!

Every part of the wall of the room on which the light of the candles falls reflects the light to all other parts of the room. Now, suppose the wall were divided into square inches, and that it contained twenty thousand of such compartments, each sending out a distinct and separate radiating ray of light. Each ray, before it arrived at the opposite side of the room, would have to cross those twenty thousand rays of light at every conceivable point of its course; and if we presume light to be governed by the same laws as other matter, it would appear an utter impossibility, that after these innumerable interferences of the rays of light, each separate ray should proceed in its course without the least impediment or change of direction, though the other rays against which it must impinge are travelling with immense velocity, and in different and opposite directions. But if, instead of supposing that only one ray of light issues from each square inch, we conceive,—which is, in fact, the

case,—that a distinct ray of light proceeds from every perceptible point of the wall's surface, the number of crossing rays from one side of the wall alone would exceed 200,000,000, and those rays would have to meet and cross each other at every conceivable point of the progress of every ray. When we take into consideration also that these rays must meet throughout their whole line of direction with rays issuing from the opposite walls, and pursuing a directly opposite course, the mode by which each ray arrives, unobstructed, in a direct line from the luminous point whence it issues, is utterly inconceivable.

The difficulty is not removed by adopting the Cartesian theory, that light is communicated by the rapid vibrations of a peculiar subtile fluid; for in that case the vibrations must be communicated with a velocity equal to that of the previously supposed motion of the particles of light, and the chords of vibration must cross and oppose each other in all the innumerable points in which the different rays come in contact; and we should be at an equal loss to conceive how these chords of vibration could be continually meeting and opposing each other without being destroyed, as we are to imagine the possibility of the rays crossing and meeting, without being obstructed or altered in their course.

If the confirmation of such facts depended

on other than demonstrative proofs, the idea of any subtile fluid moving with great velocity and coming into contact at every point of its progress with a similar fluid moving in opposite directions, without having their courses stopped, impeded, or changed, would be considered so totally opposed to sound reasoning, that they would be rejected without hesitation, and the propounder of them would be considered as a madman. These apparent impossibilities must however occur; for it would be still more impossible to conceive that the light from any object could be conveyed to the organs of sight unless some communication were made between the object and the eye; and a number of experiments have established the position beyond a doubt.

The refraction of light, also, and the effect of its refraction through convex lenses, exhibit phenomena altogether incomprehensible to man. When the rays of light fall upon a plane surface, no image of the object is formed, because rays issuing from all parts of the object fall upon every point of the surface that receives them, and therefore it presents only the appearance produced by the mingling together of all the rays of light; but when the rays are allowed to pass through a convex lens, and are then received on a white surface, in the focus of the glass, a perfect and bright image of the ob-

ject is perceived; because in that case each pencil of rays is converged to a separate point by refraction in passing through the lens.

Let us suppose, for instance, the object to be a man standing at some distance from the glass. Diverging rays of light from his feet will be transmitted and spread over the whole surface of the convex lens; similar diverging rays will proceed from his head, and will be also received on the whole surface of the glass; and every conceivable intermediate point will send forth similar pencils of rays, the whole of which will be received upon the lens; on every point of which there will be collected rays from every part of the figure of the man that is placed towards the glass. The effect of the refraction of the rays of light by the lens is to bring those rays that, before entering the refracting medium, are diffused and mingled together, into distinct and separate points; and if a plane receiving surface be placed where the different rays are collected, an inverted image of the man is perceived. If these converging rays were not obstructed by the screen placed to receive them, they would, after meeting in a point, again diverge and cross each other millions of times, and might afterwards be again collected into a focus by another lens, and form again a distinct image of the man, notwithstanding the condensations, diffusions, and incalculable intersections that each ray has ex-

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perienced. The rays might, indeed, be thus transmitted through a series of glasses, and after converging and diverging numerous other times, be still collected into a focus and form an image of the original object.

The composition of light is another of its incomprehensible properties. That the apparently pure white light which proceeds from the sun, and is reflected from the sheet of paper on which I am writing, should be composed of every variety of colour, seems so contrary to all our preconceived notions as to be at first perfectly incredible; and the assertion that white is a combination of all colours, and that black is produced by the absorption of light, and is therefore positively invisible, would, among persons not conversant with physical science, expose the utterer of those truths to ridicule. The different degrees of the refrangibility of the coloured rays, and the manner by which they are acted upon by different bodies—which possess the power of decomposing light, and of absorbing some of the rays and reflecting others — are also subjects utterly beyond the reach of human reasoning, and those effects, if not absolutely known to take place, might be deemed to be impossible.

It would extend our observations on this subject to too great a length, were we to attempt to enter into the consideration of all the properties of light that are beyond the comprehension of

man. The polarisation of light, by which it becomes apparently destroyed—the phenomena of the interference of light, which seems also, under certain circumstances, to destroy it by the meeting of opposing rays—and other highly interesting properties of light that have been recently discovered, and are yet but imperfectly known, tend to show that this subtile fluid is endued with properties, and is governed by laws, that far surpass the narrow limits of our faculties to comprehend.

Nearly all the known properties of light seem to contradict our best-established opinions respecting the laws of motion, and are frequently opposed to the primary evidence of the sense of sight itself; yet they are proved by demonstrations so clear as not to admit the shadow of a doubt. When we find, therefore, the results of human experience with regard to tangible matter to be completely inapplicable to so subtile a property as light, how much more diffident ought we to be in drawing conclusions from the observed operations of material substance respecting an essence so inscrutable as that of mind! and if, in the former case, our deductions from ordinary experience are fallacious, the objection to any presumed operation, or state of existence, of the mind, founded on no other basis than that of its supposed opposition to common experience, dwindles into

nothingness. It is, however, upon this foundation that the objections raised by materialists to the existence of the soul in a separate state from the body, principally, if not entirely, depend.

We have hitherto considered the properties of light only as affording evidence to prove that the existence of the soul in a state of separation from the body is not *impossible*. They may however be adduced as affording direct analogical evidence of the *great probability* of the sentient principle being distinct from a material organised frame, and continuing to exist when the latter is dissolved.

Every material substance possesses the power of absorbing, transmitting, or reflecting the light that impinges on its surface. If the surface of an opaque body be perfectly smooth, like that of a mirror, nearly all the rays of light that are not absorbed are reflected in one direction, and are only visible in the line of reflection; but if the surface be uneven, like that of a sheet of paper, the rays are diffused in every direction, and the object from which they are reflected may consequently be seen from all points. The light reflected from these bodies, we have reason to believe, moves with a velocity equal to that of the incident rays from the luminary which they reflect; but in what manner the reflection takes place, or by what power bodies impel light with so great a velocity, we have no means of ascertaining.

Owing to some peculiar conformation of the surfaces of bodies, also, they possess the power of separating the coloured rays, and of absorbing some and reflecting others. It is the power of reflecting light that renders all objects visible; and the property of decomposing the rays and of absorbing them, causes their distinctions in colour.

These properties of all visible objects seem to be distinct from those of the substances themselves, and act only on their surfaces; for by painting, or by otherwise altering, the surfaces of bodies, their colours and powers of reflecting light are completely changed, without any change having been effected in their substances. If any object that reflects the rays of light, an orange for instance, be placed on a black ground, it becomes more distinctly visible from the contrast; but if its surface be painted black, and it is again placed on the same ground, it will not be discerned; for it will then absorb nearly all the rays that fall upon it, and as the ground on which it rests does the same, there will exist no distinctive reflection to mark its outline. The body of the orange has, however, undergone no change by the process of colouring, and it remains in the same state, though its presence is no longer perceptible.

If a ray of the sun's light be admitted through a small hole in the shutter of a darkened room,

and be permitted to fall upon a piece of black cloth, which reflects none of the light, the room will appear to be in darkness, notwithstanding the ray of light from the sun passes directly through it. If, however, an orange or other bright object be placed in the ray, the reflection of the light from its surface will not only render the object distinctly visible, but will diffuse light to all parts of the room. Now in this case no more light actually enters the room when the reflecting substance is placed in the ray, but, owing to the peculiar conformation of the surface of that body, it is enabled to decompose the light, and to absorb all the coloured rays but the one which gives it its peculiar colour; and that ray it reflects with inconceivable velocity in every direction. If the reflecting substance be removed or destroyed, the room will again become dark, for there will be no longer any object to reflect the rays. But are we to suppose that with the destruction of that substance the light it emitted is also destroyed? The presence of light is, indeed, no longer apparent, nor is the substance that reflected it capable of again exerting the same power; but, nevertheless, the light exists with equal force, and possesses the same properties, though the form of the object that caused the previous sensation of light and colour is destroyed. The reflecting substance was only the

medium through which the presence of light was manifested to the senses; and though the peculiar properties of the body enabled it to decompose the rays, and to reflect only a portion of the colours that are combined in the white light of the sun, yet those properties produce no effect upon the rays issuing through the aperture until they actually impinge upon the surface of the reflector; and when that body is destroyed or removed, the light streams onward, unseen indeed, but still existing with the same energy as when rendered sensible to the visual organs by the agency of a body competent to reflect it.

If we were unable to ascertain that the light in this case is not dependent for its existence upon that of the reflecting body, the phenomenon would strongly countenance the supposition that the light and colour must be extinguished with the body by which they are apparently called into existence, and through whose medium alone we become sensible of their presence. We perceive a given substance presenting a certain form and colour, and communicating light all around. When that body is destroyed no trace of light remains, and we are involved in darkness. If we were ignorant of the source whence the light is derived, would not the supposition that the light and colour are still existing unaltered and undiminished, and that the substance we

beheld was not the cause of the light, but was merely endued with properties capable of rendering them apparent, be deemed utterly incredible? Assuming, therefore, that we were ignorant of the cause whence the light originated under such circumstances, it would, we contend, be equally difficult to imagine the continued presence of light and colour in the midst of darkness, as it is, in our admitted ignorance of the nature of the sentient principle, to conceive that it should continue to exist after the dissolution of the body; and the sceptics might raise even more weighty arguments against the former hypothesis than any they are able to advance against the latter.

These phenomena of light bear a strong analogy to the presumed independence of the soul, and its continued existence after the dissolution of the body. In the two illustrations just adduced we perceive substances possessing certain properties, by means of which they convey to our minds impressions of light and colour. Of the nature of those properties, or by what means they are called into operation, we can form no idea, but it is by their action that we become acquainted with the existence of the objects possessing them. The object, in the latter illustration, is supposed to be decomposed, and the light and colour that previously rendered it visible are apparently destroyed for ever. Not-

withstanding this apparent annihilation both of the substance and its properties, we are able to ascertain, from our knowledge of the source whence the light is derived, that the destruction of that peculiar conformation which excited the sensation of light and colour in our minds has had no effect whatever on the quantity or on the nature of the light itself; which continues the same, though invisible, and exists unchanged, though the substance which served to manifest its presence is dissipated. The first of these illustrations — which represents the object that reflects the light as unaltered, though rendered invisible by a change in the reflecting powers of its surface — may be considered as symbolical of the condition of a living being in a profound sleep or trance; when the body retains its vital powers without exhibiting any signs of vitality. The latter illustration—of the continued presence of light and colour after the destruction of the reflecting body — may be regarded as representing the sleep of death, and the decomposition of the human frame, whilst the inscrutable, incorruptible essence, that endued it with vitality, survives, independent of the material organisation which is requisite to render its existence appreciable by our imperfect organs of perception.

CHAPTER X.

HEAT.

HEAT and light are so closely connected in most of their phenomena, and their properties bear so near a resemblance to each other, that it has long been a question among philosophers whether or not they are identical. The results of numerous experiments, however, tend to the conclusion that they are distinct; for the rays of light can be separated from those of heat, and a high degree of heat can be produced without any visible light.

Though we are well acquainted with many of the effects of heat, we are as ignorant of its causes and modes of operation as we are respecting the nature and action of light; and the theories framed for the explanation of the phenomena are equally at variance. Whether heat be a peculiar and distinct subtile fluid, or whether it be merely an effect produced by vibratory motions of the ultimate particles of matter, is a point far from decided; but the former hypothesis, as being the more simple of the two, and as affording a more intelligible explanation of the phenomena of heat, is the one that will be adopted in the succeeding observations. The other theory, indeed, seems to in-

crease the difficulties of the subject instead of rendering it more clear; because, even granting that certain vibrations of the particles of matter might produce the sensation and effects of heat, we should still be at a loss to understand how these supposed vibrations could be communicated to the particles of solid masses. The weight of evidence, indeed, seems to preponderate so strongly on the side of the former hypothesis, that nothing short of the opposition it met with from that distinguished chemist, Sir Humphry Davy, could we imagine have shaken the belief in it as an established theory.

According to the hypothesis which considers heat as a peculiar fluid, that subtile matter is supposed to pervade all substances, and to surround their minutest particles. It is supposed to be endued with a strong repulsive power which tends to separate the particles of the bodies it surrounds; and in proportion to the quantities of this calorific matter distributed among the particles of such bodies, their cohesive attractions are presumed to be increased or diminished; and they assume the form of an air, a liquid, or a solid.

Every substance, according to the same theory, possesses a certain capacity for caloric; that is, an inherent degree of attraction for the *matter of heat;* the amount of which attraction varies in different bodies, and even in the same bodies

under different circumstances. When the quantity of heat which any substance contains does not exceed its natural capacity for caloric, the heat is not perceptible, and it is therefore said to be *latent* in such body. When the capacity for caloric is by any means diminished, the superabundant heat is evolved and becomes perceptible; and this effect is in almost every known instance produced when the specific gravity of any substance is increased; whether it be by hammering, by compression, or by chemical action. In such cases the particles of matter are brought into closer contact, and a portion of the heat surrounding them is supposed to be liberated, or *squeezed out*, and thus to produce the sensation of heat.

The foregoing is a brief outline of the leading points of the hypothesis which is at present considered to afford the best explanation of the phenomena of heat. It must be observed, however, that this hypothesis does not attempt to explain the mode by which the supposed calorific matter communicates the sensation, or produces the effects of heat; for that is a question which lies beyond the reach of the human understanding. It merely attempts to explain the operation of *secondary causes*, for of the primary cause of the sensation of heat we are incompetent to form an idea.

Let us next proceed to consider how this

hypothesis of the nature of heat and its modes of action can be applied in support of the argument for the existence of the soul distinct from its connection with the body.

Heat pervades all substances, and is so essential to the maintenance of them in their respective forms, that it may be regarded as constituting one of their essential parts. We are led to infer from the results of all experiments that have hitherto been made, that every substance—even the air we breathe—would, if totally deprived of heat, become solid; and that, on the contrary, by the infusion of heat, every solid substance might be converted into elastic invisible vapour.

Water affords the most simple illustration of this power of heat. When the temperature of water, for instance, is reduced below 32° of Fahrenheit's thermometer, the liquid particles lose their power of moving freely among each other, and the mass assumes a solid form, which bears no resemblance in mechanical properties to the water from which it was congealed. If, on the contrary, the temperature of the water be increased till it arrives at 212°, the liquid becomes converted into an invisible vapour. The latter form is not less opposed to what we are accustomed to consider the natural state of water, than that of ice; and the difference between an invisible aqueous vapour and a solid mass of ice

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is so immense, that if we were not well acquainted with the fact that they are convertible into each other, or if we were destitute of analogical evidence from which that circumstance might be inferred, such a complete metamorphosis would be considered highly improbable, if not altogether impossible. If the temperature be increased beyond that of boiling water, the invisible vapour will exert an expansive power, sufficiently great to tear asunder the strongest vessels in which it may be confined; and when this power is properly applied, by the ingenuity of man, it becomes one of the most energetic and most useful moving forces that have been made subservient to his will.

These four distinct and opposite forms into which water may be converted, are produced simply by the increase or diminution of heat, and yet heat itself, which effects these astonishing changes in the appearance and properties of the water — which softens the solid mass into a flowing stream, which dissipates the liquid into the ambient air, which bestows on the invisible vapour a giant's power — exists in a state entirely distinct from, and by no means necessarily connected with, the body to which it is united. The heat may be abstracted from the steam, from the vapour, from the water, and even from the ice, and it will not be destroyed or altered by the changes of form in which it has been

combined, whilst the mechanical properties that were imparted to the more material substance by heat will be completely destroyed by the absence of that subtile property.

The same general effects that are produced by the combination of heat with water are known to result from its union with other fluids. The increase or diminution of heat in alcohol, the oils, and even in mercury, produces the effects of distillation or congelation. Mercury, — a metal possessing so large a capacity for caloric as to assume a liquid form at a temperature much below that at which all other metals are solid — when deprived of its caloric of fluidity, that is, when its temperature is reduced to 39° below the zero of Fahrenheit, becomes solid, and resembles the other metals. In that state it possesses the quality of malleability, and may therefore be hammered into plates as thin as a sheet of paper; and during Captain Ross's polar expedition he cast bullets of solid mercury, which were fired through a thick board. This singular metal may therefore be considered to be melted by a temperature higher than 39° below zero; an addition of heat converts the ponderous opaque metal into a volatile invisible vapour, and if heated in a closed vessel the expansive force of the compressed vapour exerts a power equal to that of steam. If the subtile fluid that endues the metallic vapour with power,

and its solid particles with fluidity, be withdrawn, the effects cease, and the mercury entirely changes its character and mechanical properties, and becomes an inert and immoveable mass, whilst the heat that pervaded its particles, and imparted to them the properties of fluidity, volatility, and elastic power, exists undiminished and unchanged.

Who can fail to observe in the foregoing illustrations of the combinations of heat with material substance a striking symbolical analogy to the union of the sentient principle with the human frame? The difference between an etherial invisible vapour and a solid impenetrable substance, is as great as any change we can imagine matter to undergo; yet these changes we find are consequent merely upon the withdrawal of an imperceptible fluid, which, though the sole cause of these modifications in matter, is itself not affected by those changes; and when separated from the substance with which it was combined is unimpaired and undiminished.

If we pursue this inquiry into the properties of heat still farther, we shall be enabled to collect additional facts in support of this analogy.

When the subtile properties of heat are compared with tangible substances, we are ready to imagine that its particles must exceed in minuteness all other possible forms of matter; yet when we consider heat in its numerous combina-

tions with light, the latter seems still more etherial; and if heat be, as there is good reason to believe, distinct from light, we shall be obliged to admit that the matter of heat is of a grosser nature than that of light. Several of the phenomena of light and heat appear clearly to indicate that they are not identical; and to some of those which mark this distinction we shall now briefly allude, with a view to give additional weight to the argument to be derived from the separate existences of material bodies that seem, on a superficial view, to be necessarily dependent on each other.

Light, as we have before observed, is communicated with inconceivable velocity, and penetrates all transparent media. Its progress is impeded, if not altogether stopped, by the interposition of opaque bodies. In many cases the calorific rays obey the same law, and are transmitted in combination with the rays of light through transparent media, whilst in other cases, the rays of light are alone transmitted and those of heat are obstructed. These instances of the separation of heat from the rays of light seem to confirm the opinion that light and heat are two distinct properties, or forms of matter; for if they were identical, the substance that admits or obstructs the passage of heat would, we must conceive, also transmit or obstruct the passage of light.

The rays of light from a blazing fire are readily transmitted through glass, but a plate of glass forms as complete a screen against the heat of the fire as if an opaque body were interposed. On the other hand, a sheet of iron, the surface of which is blackened, when held in the same place, will completely obstruct the rays of light, and will absorb all the rays that impinge on its surface. The heat, however, will not only penetrate the opaque metal, but calorific rays will be reflected from its blackened surface in all directions. Again: transparent rock-salt will transmit the rays of heat and light from the fire without obstruction, whilst black quartz totally obstructs the passage of light, but transmits instantaneously the rays of heat, as if no substance were interposed.

Another marked distinction between light and heat consists in the different modes by which they are diffused. Whilst light is transmitted with a rapidity greater than that of lightning, and, so far as we can ascertain, always with unvarying velocity; heat is transmitted in more modes than one, and with greatly differing velocities. When transmitted in combination with light, it is communicated with the same velocity as that subtile fluid. When transmitted by radiation unconnected with light, it is also communicated with a velocity probably equal to that of light, though we have no means, in such case,

of measuring with accuracy the rapidity of its communication; but when heat is diffused by conduction, from one body to another, it is communicated slowly from particle to particle of the matter, through the whole mass. Even in the latter mode of diffusing itself, heat varies in the rapidity of its communication according to the nature of the substance through which it moves; and presents, in this respect, another remarkable feature that distinguishes it from light. There are, indeed, scarcely any two substances that are equally good conductors of heat; and many of those bodies that afford the readiest transmission to the rays of light offer the greatest obstacles to the communication of heat among their particles. Glass is the most familiar instance of this peculiarity. If a rod of copper and a glass rod be immersed in heated liquid, the heat will be communicated through the metal about one hundred times more rapidly than through the glass, and the extremity of the glass rod will feel quite cold when that of the copper one is too hot to be touched. Even the air, which does not obstruct the passage of radiant heat, is a very bad conductor of heat among its particles, when not in motion; and water is one of the most perfect non-conductors of heat, though it readily transmits the calorific rays when combined with light.

The tendency of these facts is to show, not only that the properties of light and heat are

distinct, but that heat itself exists in two different states. It does not, however, form a part of our present subject to speculate upon the probable modifications of the matter of heat; it is sufficient for our purpose to show that the phenomena indicate a manifest distinction between caloric and light. The results of the experiments on this subject also induce the belief that light is a more subtile fluid than caloric, and that it is, therefore, capable of penetrating media that are impermeable by heat.

At the same time that we seem compelled to admit, from their distinctive phenomena, that light and heat are not identical, their connection is, in many instances, so extremely intimate, that it is difficult to conceive the possibility of their existence independently of each other. Heat, for instance, when combined with the solar rays, is readily transmitted through glass, and is subject to refraction in the same manner as light. This fact is exemplified by a common burning glass, which concentrates the rays of light into a brilliant spot in the focus of the lens, where the heat is also concentrated with the light. The rays of heat, indeed, seem to be even more refrangible than those of light, for when the latter are dispersed by a glass prism into the primitive colours, the heat is not only refracted to the point of greatest refrangibility of the red rays, but even beyond that point — where no light

whatever is refracted — the heat is equal to, if it do not exceed, that contained in any of the coloured rays. The laws regulating radiant heat are, in other respects, similar to those of light, though they are brought into operation by different agents; and the relation of these two subtile essences to each other is so intimate, that we are not acquainted with any instance in which an energetic action of the one is unaccompanied with the production of the other.

When, therefore, we find that these active and intimately connected subtile agents can be separated, and that the balance of evidence warrants the supposition that they are really distinct essences or forms of matter, all objections to the separate existence of the soul from the body, founded upon their intimate connection with each other, may be overcome; for in the instance before us we perceive two subtile essences — of whose nature or of the minuteness of whose particles we can form no conception — united so intimately as to appear one and the same, and yet capable of being dissevered and of having separate existences. The union between the sentient principle and the human frame, it must be borne in mind, is a union of two principles that are manifestly distinct, and whether or not we admit that the mind can exist without the body, we must allow that no two conceivable things can exhibit greater dissimilarity than gross

substantial matter and the subtile essence, or immaterial principle, which directs and controls it. In the case of light and heat, however, the two subtile essences possess so close a resemblance, that it becomes doubtful whether or not they are identical; and yet those closely connected properties of matter may, as we have seen, be separated, and exist, apparently at least, in separate and independent states.

There is another feature in the properties of heat that must not be omitted from our present consideration — its indestructibility.

It has been remarked in a former chapter that heat does not destroy the substances which call it into action; and we shall now endeavour to show that heat is itself not destructible. When a heated substance is exposed to an atmosphere cooler than itself it rapidly parts with its heat, and becomes at length of the same temperature as the surrounding air; and the rapidity with which it cools increases in proportion to the difference between the two temperatures. The heat is not, however, lost. It is distributed among the surrounding substances, that were not so hot as itself; it is also conveyed by radiation to distant objects, and the result of the cooling process is to communicate to other bodies as much heat as is lost by the body cooled.

In some instances, indeed, there is an apparent absolute loss of caloric, but it is only an appa-

rent and not a real loss. When, for instance, a cup containing heated water is placed in a basin of ice, the heat of the water will be rapidly diminished, and a portion of the ice will be melted; but the melted ice will be found to have not received the least increase of temperature. The heat is not, however, annihilated; — it has been absorbed by the water in assuming a liquid form, and it would be evolved if the water were to be again frozen. It is, indeed, a well-known fact, that all bodies in passing from a denser to a rarer state absorb heat; and that when their density is restored the same quantity of heat is evolved; consequently, when the denser ice becomes water a quantity of heat is absorbed in a latent state by the liquid. This heat is termed its caloric of fluidity. When the water is converted into steam, a still greater quantity of heat is absorbed without any increase of temperature; and it is rapidly evolved when the steam is again condensed into water, and its capacity for caloric is thereby diminished. The phenomenon of combustion has been previously explained upon this principle; for when the oxygen gas of the atmosphere is suddenly condensed by entering into solid combination with the combustible substance, the heat contained between the particles of the gaseous fluid is suddenly liberated and rendered sensible. Numerous similar experiments might be adduced to prove that heat is never annihi-

lated, and that when it is brought from a latent into an active state it is again diffused, by radiation and by conduction, to other bodies.

We have now briefly alluded to the three remarkable characteristics of heat which more particularly support our general argument; first, the nature of its combination with tangible matter; secondly, the nature of its combination with light; and, thirdly, its indestructibility. Each of these characteristics affords analogical evidence in confirmation of the position that the living principle in man may exist after the organised form of matter which it animated is destroyed.

The phenomena attending the union of heat with solid bodies — the forms of which it completely changes, and seems to constitute a component part of their compositions, whilst it is, in fact, entirely distinct from them — is, in the first instance, an illustration of the possibility that a still more subtile essence, which enters into combination with matter, and regulates its actions, may possess an existence independent of the material organisation with which it is combined. The separation of the intimate, and apparently necessary, connection between heat and light — each supposed to be an extremely subtile essence, and therefore the more capable of entering into a close union — and their exhibition in distinct and separate states, affords, in

the second case, additional confirmation to the position that the sentient principle, which we feel to be of a nature totally distinct from material substance, may exist when the body to which it is attached is decomposed. And when, to this evidence confirmatory of the *possibility* of the soul existing in an independent state, there is added the inference to be drawn from the indestructibility and unchangeableness of heat, the presumption in favour of this position assumes a high degree of *probability*.

Numerous other phenomena of heat might be adduced to support the foregoing inferences, but a more detailed illustration of them would convert this notice into a regular treatise on the subject, and our present purpose is merely to point out some of those leading properties that seem to bear most directly on the argument.

Were we to adopt the hypothesis that heat is not a distinct fluid, but is excited merely by vibratory motions of the particles of matter, and that light and heat are the same; though these views of heat and light would present the argument in a different shape, they would not materially affect the argument itself. For, in the first place, the cause of the vibrations must be considered as something distinct from the vibrating atoms, and from the effects which those vibrations are supposed to produce; and, in the second place, were light and heat to be con-

sidered merely as different modifications of the same subtile matter, the causes of those modifications, which could represent that matter under such different aspects, and subject to such different laws, must be distinct from the matter itself. Whichever theory, therefore, we adopt, to explain the effects of heat or its connection with light, the phenomena will be equally applicable in support of the argument founded on the analogy of the separate independence of subtile essence in its connection with material substance.

CHAPTER XI.

ELECTRICITY AND GALVANISM.

THE discoveries in physical science, at the same time that they have extended the bounds of human knowledge, have also exhibited in clearer view the limited extent of the human capacity; for every new discovery opens a fresh field of inquiry, an additional source of wonder, and presents in a more humiliating view our inability to comprehend those numerous causes that operate on, and produce the various modifications of, matter. It is true these investigations tend to show that many of the apparently different forms of matter are merely different modifications of one simple element, and by thus reducing the number of the primary elements, they greatly simplify our ideas of the operations of nature. But the causes of those modifications, which produce such important changes in the forms of bodies, seem more incomprehensible than the supposition of the existence of different distinct elements; and the various hidden properties of matter which philosophic inquiries have developed — each of them inscrutable to man — open to view a boundless prospect of a

land unknown, which serves, however, but as the foreground to other and more distant scenes, the outlines of which are not discernible in the obscure horizon.

These observations are peculiarly applicable to the science of electricity. Though the electric attraction was noticed before the foundation of any of the physical sciences, the subject remained dormant for a series of ages, and the principal discoveries that render electricity worthy of being denominated a science have been made within the present century. It is indeed still in its infancy, and each succeeding year additions are made to the facts previously known, which contribute to increase the importance of this curious and highly interesting branch of knowledge. When Thales, the Milesian philosopher, first discovered that amber on being rubbed possessed the power of attracting light bodies, he little imagined that the agent thus excited by friction of the gem, was identical with the lightning of heaven; and when Franklin's genius succeeded in drawing lightning from the clouds, and he proved the identity of the thunderbolt and of the electric spark, he had no idea that subsequent discoveries would prove the apparently evanescent electric fluid to be one of the most constantly active chemical agents, or that it is — as recent discoveries have almost

established—identical with the magnetic attraction which points the needle to the pole.

Notwithstanding, however, the great advances that have been made in this science since the time of Thales, we possess as little knowledge of the nature of electricity as that ancient philosopher, who attributed the active power of the amber to the rousing of a dormant soul within the precious stone, which he supposed then issued forth and brought back the light surrounding bodies. The extension of our knowledge of the properties of electricity and of its identity, in a modified form, with other agents, has thrown no additional light upon the nature of that subtile agent itself; but has, on the contrary, added to the previous difficulty of forming a conception of its nature, another one nearly as great respecting the modifications which the same fluid receives to enable it to assume forms so different and properties so various.

The opinions respecting the mode in which electricity is evolved differ even more widely than those respecting heat and light; because, in the case of electricity, there are, apparently, two distinct species of the same fluid to take into consideration, which seem directly opposed to each other.

The phenomena of electricity, like those of the other properties of matter already noticed, are attributed by contending theorists to the

existence of one or more subtile fluids; or, to the excitement of peculiar motions among the minute particles of matter. The theory of Dr. Franklin is the most simple of any, and as it affords a satisfactory explanation of most of the phenomena of electricity, it is the one that will be adopted in the subsequent remarks when reference to theoretical explanation is necessary.

Dr. Franklin's theory supposes that electricity consists of one all-pervading subtile fluid, which is generally diffused through all substances; and that the phenomena of electricity are produced by any cause which disturbs the equilibrium in the surrounding bodies, and conveys to the body positively electrified more than its natural share; to produce which effect some other body must be deprived of its natural proportion of the electric fluid. Other electricians are of opinion that there are two separate electric fluids, the one excited by glass and the other by resins. The latter opinion, which for a time was supplanted by that of Dr. Franklin, has latterly been revived, though apparently without sufficient reason, for not only is the theory of Dr. Franklin the more simple, but it is less liable to many objections that may be raised against the theory of separate electric fluids.

It will be observed, however, that neither Dr. Franklin's, nor the other theory, attempts to

give an explanation of the ultimate cause of the phenomena. For if we take for granted that they are excited by the *plus* and *minus* states of one subtile fluid, and that the effects we witness are produced by the efforts of this fluid to regain its natural state of equilibrium, we shall still be as much at a loss as the man who witnesses them for the first time, to comprehend the nature of this supposed uniform fluid, or to understand how the restoration of its equilibrium can produce the extraordinary sensation and effects — accompanied with light and heat — which characterise the phenomena of electricity.

The circumstances that render the electric fluid peculiarly mysterious are, the various methods by which it is excited, the extraordinary chemical and mechanical effects it produces, and the singularity of the laws it observes.

The excitement of electricity, there is reason to believe, is caused by every chemical or mechanical change in the constituent parts of bodies; but the readiest mode of exciting common electricity is by friction. When, for instance, a dry glass tube, or a stick of sealing wax, is rubbed briskly with the hand, or with any non-conducting substance, it immediately becomes highly electrical, and emits sparks, and attracts all light bodies placed within its influence. When a feather is held near an excited tube of glass,

it is attracted with great energy; but after the electricity of the tube has been communicated to all the fibres, the feather will fly off from the glass, and will then be repelled by the tube, if brought near it, until the feather has parted with its electricity to some other object, when it will be again attracted by the tube. If an excited stick of sealing wax be brought near the electrified feather whilst it is floating in the air, instead of being repelled by this electric, as it was by the glass, it will be strongly attracted; after the electricity of the wax, however, has been communicated to the feather, its fibres will be repelled, and it will then again rush towards the glass tube. If the excited glass and wax be held near to each other, the feather will be attracted from one to the other alternately, until the powers of the excited electrics are exhausted.

These effects are produced in consequence of the glass tube and the stick of sealing wax being in opposite states of electricity. According to the theory of Franklin, the friction of the glass disturbs the equilibrium of the electric fluid, and enables it to acquire more than its natural share; which additional quantity it has received from the substance with which it is rubbed, and the glass is therefore *positively* electrified. The friction of the wax, on the contrary, according to the same hypothesis, produces the opposite effect of diminishing the natural quantity of

electricity in the wax, which is therefore in a *negative* state of electricity. The attraction between a substance positively, and one that is negatively electrified, is thus supposed to be caused by their reciprocal endeavours to regain their natural states. The vitreous and resinous theory supposes the electricities excited in this manner to be two distinct fluids which possess a strong reciprocal attraction, and an idio-repulsive power among their own molecules. In accordance with this hypothesis, the feather, when electrified with either the vitreous or the resinous fluid, has a repulsive power imparted to it, which repels it from that electric; and the attraction which electrified bodies possess to the opposite kind of electricity, impels it towards the other electric.

It is difficult, if not impossible, however, to account for several of the phenomena of electricity on the supposition of the existence of two separate electric fluids; and the effects of the repulsive power, which is ascribed to the molecules of the electric fluid, may be satisfactorily explained by the force of attraction alone. It is therefore advisable not to obscure a subject, which is sufficiently difficult to comprehend, with needless complexities; and the theory of Dr. Franklin is so extremely simple, and is supported by so many experiments, that the revival of the old and exploded theory of

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vitreous and resinous electricity seems unaccountable.

The common effects produced by the excitement of electricity—its power of instantaneous transmission through metals and other conductors, and its obstruction by glass and the whole class of electrics — its mechanical force in rending asunder, perforating, or removing any non-conducting body that obstructs its passage—its power of setting fire to combustibles, and of deflagrating the metals—and its peculiar effect on the nerves and muscles in the electric shock, are generally well known; and though they present highly interesting subjects for consideration, the limits of this work will not allow us to pause on those phenomena. We must proceed to those branches of the science more particularly connected with chemical action.

The phenomena of galvanism bear so strong a resemblance to those of electricity, that soon after the invention of the Voltaic pile, in which those phenomena were strikingly exhibited, it was suspected to be only a modification of the same power, and this opinion has since been fully established. As it would be incompatible with our present object to attempt to explain the different modes by which galvanic electricity may be excited, or to enter into a statement of the varying opinions respecting its mode of

operation, a very brief outline must therefore suffice.

If a piece of zinc and a piece of silver be applied to the tongue, the one above, and the other underneath it, no sensation will be experienced until the ends of the two metals are brought into contact; but as soon as they touch, a strong metallic taste will be immediately perceptible. This peculiar taste is caused by the excitement of galvanic electricity in its simplest form. When several zinc and silver discs are placed alternately upon each other, with an intermediate piece of moistened cloth of the same size as the metal discs between each pair, the effect is increased in proportion to the number of the discs employed. This combination of metals and intervening moistened cloth constitutes the Voltaic pile, which exhibits decided signs of electricity when a communication is formed by proper conductors between its extreme ends. The effect of this combination of metallic discs is greatly increased when the intervening pieces of cloth are moistened with an acidulous mixture that will act upon the zinc. It is still further increased by exposing the metals to the free action of the liquid menstruum; for which purpose zinc and copper plates are cemented into troughs, with a space between each pair of plates for the reception of the acid. A combination of these troughs constitutes the galvanic

battery, which forms one of the most powerful agents in the decomposition of bodies that chemists possess. To produce these effects, it is necessary that of the two metals employed one should be more easily oxidizable by the fluid than the other, and in proportion to the difference in this respect, and to the strength of the acid menstruum, will be the quantity of galvanic electricity excited. It is also essential that the liquid in the different compartments should be prevented from communicating.

When the galvanic arrangement is completed, the affinity of the acid for the most oxidizable metal produces a reciprocal decomposition of the metal and the liquid, which excites, in some unknown manner, the galvanic electricity. The electricity excited in the first pair of the series of plates is transmitted through the fluid to the next, and is thence communicated to those succeeding. The quantity of electricity is increased at each transmission by the amount of electricity excited by each succeeding pair of plates, until the whole force of the electricity generated by this arrangement is collected at the terminating pairs in the series.

The electricity thus excited is not momentaneous in its operation, like that excited by friction : — its action is continuous, at imperceptible intervals, until the acid menstruum becomes saturated, and ceases to act on the metal. Gal-

vanism differs, likewise, from common electricity in the lower degree of its intensity; but in most other characteristics, and in their general effects, they bear a close resemblance, notwithstanding the difference of the modes by which they are called into action.

Among the effects of galvanic electricity the decomposition of water presents some extremely curious phenomena, that deserve particular notice. When the wires of the opposite poles of the galvanic circle are immersed in water, the decomposition of that fluid immediately takes place; a stream of hydrogen gas will issue from the wire of the negative pole, and if the wires employed be made of platinum, gold, or silver, a stream of oxygen gas will be evolved from that one connected with the positive pole. If, however, the wires be metals easily oxidizable, the oxygen evolved from the positive pole of the galvanic circle, instead of being exhibited in a gaseous state, will unite with the metal and form a metallic oxide. The relative quantities of the gases evolved by this process are exactly in the proportion that constitutes water, and it is clear, therefore, that the gases produced are derived from the decomposition of the water, and that the attraction of the positive wire for the oxygen, and of the negative wire for the hydrogen, must be sufficiently powerful to disturb the strong chemical affinity subsisting between the oxygen

and hydrogen in the water. Those two elements of water must also derive from the electric current the caloric necessary for their assuming a gaseous form.

The distance between the ends of the wires immersed in the water in this experiment is immaterial, the same effect being produced whether they are brought within half an inch, or are removed half a yard asunder; and it is still more singular that the same phenomena occur when the wires are placed in separate vessels of water, merely connected by a piece of moistened asbestos. The particles of water operated on are, in the latter case, apparently distinct, yet the process of decomposition proceeds with the same facility as before, and the result gives the same proportions of hydrogen and oxygen which constitute water. It is evident, therefore, that notwithstanding the galvanic influence is communicated through separate portions of the fluid, and the decomposition takes place in detached vessels, that the portion of water which is decomposed is the same; and the hydrogen or oxygen must, after separation from their aqueous combination, traverse from one vessel to the other, through the communicating fibres of asbestos, though no indication of the transmission can be detected.

These phenomena, taken collectively, afford additional proof of the incompetence of the human intellect to comprehend either the agents

employed by nature, or their modes of operation. For—putting altogether out of consideration our total ignorance of the electric fluid, and of the processes by which it is excited — we can form no idea by what means that power can weaken the strong affinity of oxygen and hydrogen in water, nor imagine how it is possible for the hydrogen gas to be transferred from one vessel to the other without being dissipated, and even to descend through the liquid to the point of the negative wire.

These effects of the influence of galvanic electricity are not, however, more extraordinary than those produced by increasing and suspending the chemical affinities of different bodies; to a few of which we shall now briefly allude. When clean pieces of silver and zinc are placed in a solution of sulphate of copper (blue vitriol), no decomposition of the solution by the silver will take place whilst the metals remain apart; but when the zinc is brought in contact with the silver, the affinity of the latter for the copper will be increased; it will then decompose the metallic solution, and a thin film of copper will be deposited on its surface. The simple contact of the zinc appears in this instance to have produced some important change in the chemical properties of the silver, though in what manner this change is brought about by the influence of

the galvanic electricity, excited in so small a degree, we are unable to discover.

The following example of the suspension of chemical affinity by the influence of galvanism is still more curious. If the wires of the positive and negative poles of a galvanic battery be inserted, the one into an insulated cup containing an alkaline solution, and the other into a cup containing an acidulous mixture; and if both these cups be connected, by moistened fibres of asbestos, with an intermediate one containing water, the acid in the cup connected with the negative pole will be imperceptibly conveyed by the connecting fibres of asbestos into the intermediate cup, and will be thence transferred to the cup connected with the positive pole of the battery. The alkali will, in the same manner, be transferred from the cup connected with the positive end, and be conveyed through the intermediate cup of water to that with which the negative wire is connected. During this process the acid and alkali, which possess a strong affinity to each other, must have been brought into contact in the intermediate cup of water, and during their passage along the connecting fibres of asbestos, without combining. The water, also, which possesses a strong chemical attraction for both the acid and the alkali, has allowed them to traverse its particles without retaining either; and the result of the experiment is, that the acid

and alkali have changed places without any chemical combination having taken place between the three liquids, which possess, under ordinary circumstances, strong reciprocal attractions. The suspension of chemical affinities in this instance, under the influence of galvanic electricity, is quite unaccountable in our present state of knowledge, and presents another fact from which man may learn to doubt the correctness of positive conclusions founded only upon his limited acquaintance with the influences which the subtile — and to him inscrutable — properties of matter may exercise upon the combinations and existences of different bodies.

Similar effects take place when a solution of any of the neutral salts is submitted to the action of galvanic electricity in cups similarly arranged. If a solution of sulphate of potass, for instance, be placed in the negative cup, the chemical affinities of the salt will be altered, and the sulphuric acid, which was combined with the potass, will be transferred through the intermediate cup to that which is connected with the positive wire, and it will pass through any solution that might be contained in the intermediate cup without mixing with it, provided the solution and the acid would, under ordinary circumstances, form a soluble compound.

Having now given a general outline of the modes by which the two electricities may be

excited, and having mentioned some of their effects, we shall next proceed to notice the considerations which present themselves, on a review of these facts, that are more immediately connected with the subject-matter of the present work.

In whatever point of view we regard the nature of electricity—whether as one all-pervading fluid or as two distinct fluids, whether we consider it as merely the result of chemical action or as identical with chemical affinity — we must admit that it is distinct from the substances which develope its powers, and that the effect of electrical excitement is not to create a quantity of electricity, but to bring the latent power into operation.

Having then arrived at the fact that the electric fluid is distinct from, and exists independently of, the substances by which it is manifested, let us briefly examine the phenomena of the Leyden jar for the purpose of tracing a resemblance between the active powers bestowed on it by electricity, and the powers with which the human body becomes invested by the presence of the vital principle.

The electricity with which the Leyden jar is charged adheres to the glass, the non-conducting power of which causes it to retain the electric fluid; and the coating of tin-foil serves to conduct instantaneously to one point the

electricity that is disseminated over the surface of the glass. That the electricity is retained by the glass, and not by the tin-foil, may be clearly proved; for the inner and outer coatings of an electrified Leyden jar may be changed without materially diminishing the force of the charge. The glass jar with its coatings and connecting wires, when electrified, exhibits active properties, that might be mistaken by the ignorant as indications of animate power. It attracts and repels all light substances brought within its influence — it gives out a sound when a conducting body is brought near to its knob — it sends forth luminous rays in the dark, and it might be made to move by the attractive power of electricity if placed on an extremely delicate locomotive machine. As soon as a communication is made between the outer coating and the knob, by a conducting substance, a vivid spark is emitted, a report is heard, a convulsive shock is felt, and all the extraordinary powers of the jar are then dissipated and apparently destroyed. We learn, however, from a closer examination of the phenomena, that the quantity of electricity is not diminished by the explosion, and that the effect of the discharge has been but to restore the equilibrium that had been disturbed by the electrical excitement.

If no direct communication be made between the inside and outside coatings of the electrified

jar, the electricity will be gradually dissipated by the air until all signs of energy are gone, and the jar that was before endued with active properties will become an inert piece of matter. Not one particle of the fluid that conferred those properties is, however, lost or changed; though, having been gradually removed from the substance through whose medium it became perceptible to our senses, we are no longer able to detect its subtile existence.

Any comparison of the combinations of the forms and properties of matter with the wonderful conformation of man, governed by the sentient principle, must necessarily be extremely rude and imperfect; but in our endeavours to comprehend the connection between matter and mind, such comparisons may serve as tangible points whereon to fix our ideas; and by showing, in the combinations of matter with subtile properties, that the active powers of material substances are distinct from matter itself, and exist independently of the forms in which they are manifested, we may aid our feeble conceptions of the distinct and separate existence of the soul from the body; and the possibility of such separate existences may, by these means, be confirmed.

The analogy presented by the phenomena of the Leyden jar to the presumed separation of the immaterial principle from corporeal orga-

nisation, though it cannot be advanced as direct evidence in support of the immortality of the soul, may be at least regarded as symbolical of the changes consequent on the dissolution of the body: — the gradual decay of the mental and physical powers, and the final departure of the soul from the organised frame, which then becomes an inert mass, whilst the immortal, undecaying principle, that gave it animation, is merely transported to another state of existence.

The action of the galvanic pile presents another striking analogy to the supposed separation of the sentient principle from the body, and its independent existence after the material organisation that developed it is decomposed. The galvanic pile, when in active operation, exhibits more resemblance to an animated being than an excited Leyden jar, in consequence of the continuity of its effects; but as the acid menstruum that excites the electricity by its action on the zinc becomes saturated with the metal, the effects gradually diminish, until the action entirely ceases. The electric fluid that was brought into an active state by the mutual attractions of the metal and the liquid has not, however, undergone any diminution or increase during this process, nor is it destroyed by the cessation of the chemical decomposition; for as the chemical action did not create the electric matter, but was only the

means of disturbing the electrical equilibrium, and thereby rendering it perceptible, so the discontinuance of that action does not destroy the electric fluid, but merely restores it to a state of rest, to be again roused into action when the exciting cause is renewed.

In these instances, and indeed in every instance in which electricity is excited, we perceive a typical illustration of that important truth which it is our object to elucidate and establish; and we observe in the combination of ordinary matter with one of its more subtile properties that very phenomenon, the possibility of which is denied by some sceptics when asserted of the inscrutable connection between the material body and the immaterial soul.

Ignorant as we are of the nature of electricity, it is much more cognisable to the senses than any of the subtile properties we have hitherto considered. It can be felt, seen, heard, smelt, and even tasted, and yet we cannot form the most distant conjecture respecting its nature, or by what means it becomes perceptible to the organs of sense. When, therefore, we find that apparently insurmountable difficulties attend the investigation of the character of an agent that is subject to the examination of all the external senses, the investigation of those more subtile material properties that are not appreciable by any one organ of sensation seems a hopeless

undertaking; and we feel that it is not within the range of the highest human intellect to comprehend the nature of the soul, the mysterious attributes of which far exceed those of the subtile properties of matter.

Whilst we possess an innate consciousness of the existence of the soul, and are aware of our utter inability to comprehend it — whilst we are aware of the existence of many subtile properties of matter that are also completely beyond the reach of our intellects, though the objects of sensation, and have proof that these latter and grosser properties exercise their powers in ways that would, if submitted to the examination of human reason alone, appear quite impossible — whilst these circumstances are known to us respecting the actions of matter, we cannot surely deny that the same powers which matter possesses may be also possessed by the more inscrutable essence of the human soul. To attempt to circumscribe the operations and existence of the sentient principle within the limits of our knowledge of those laws which govern the ordinary forms of matter, when we are, at the same time, obliged to admit that many of the properties of matter itself form exceptions to those laws, seems to be completely opposed to the clearest deductions from known facts, and altogether irreconcileable with sound philosophy.

CHAPTER XII.

MAGNETISM.

MAGNETIC phenomena might, in accordance with the facts brought to light by recent investigations, have been properly classed with those of electricity; but they are in many respects of so distinct a character that it has been thought desirable to consider them in a separate chapter.

It was conjectured that an intimate relation subsisted between electricity and magnetism, shortly after the former science attracted the notice of philosophers, in consequence of the similarity of their attractive and repulsive powers, and from the circumstances that the poles of the earth, which are apparently the great depositaries of the natural magnetic influence, are also those parts of the globe where the electric fluid seems to be in most constant activity. This opinion was strongly confirmed by the discovery that a needle when subjected to the action of electricity becomes endued with magnetic power; and by the more recent employment of galvanism, instead of common electricity, a method has been discovered of imparting to iron by its means a very high degree of magnetic power. Still more conclusive evidence of their identity is afforded by

the fact, that by a peculiar combination of powerful magnets they may be made to emit an electric spark. This reciprocal production of magnetism by galvanic power, and of electricity by magnetism, proves, at least, that a close connection subsists between the two subtile principles, if indeed they are not the same.

Though the phenomena of magnetism bear a strong resemblance to those of electricity in the leading feature of their attractive and repulsive powers, they are at the same time very dissimilar in their modes of exercising those powers, and they operate by totally different agents. Electricity may, as was stated in the preceding chapter, be excited by the friction of all bodies that are non-conductors; and by chemical action it is excited in the metals, which are the best of conductors; but nearly the only substance in which magnetism can be excited is iron and its compounds. Again: the excitement of the electric fluid continues only so long as the causes that excite it are in action, and when they cease it is quickly dissipated; but when the magnetic power is once communicated it is retained by the magnetized steel for an unlimited time; it exerts its influence without diminution, and the power may be communicated from that to other pieces of steel, not only without any decrease of energy, but with an absolute increase of power by the communication. In

the manner, too, in which the magnetic power is excited, in its transmission through the particles of different substances, and in its polar attraction, by which it is more particularly characterised, magnetism seems distinguished from electricity. These points of dissimilarity seem sufficient to warrant a separate consideration of the magnetic and electric fluids, even if we should be disposed to regard them as only different modifications of the same property of matter.

The obscurity in which the consideration of the nature of electricity is involved is, if possible, exceeded by that which surrounds the investigation of magnetism; for the former is subjected to the cognisance of all the senses, whereas the magnetic power, in its ordinary developement, is not perceptible by any one. Our only knowledge of magnetism is derived from its effects, some of the more striking of which must be briefly alluded to.

We shall in the first place proceed to consider some of those peculiarities which distinguish the operations of the magnetic attraction from those of electricity. The electric attraction is not confined to any class of bodies, but is exerted towards every substance which is not in a similar state of electricity. The influence of the electric fluid, however, can only be transmitted by conductors of electricity, and when the electricity is communicated to those conductors they

participate in the power of the excited electric, and the substances brought within the electric influence are attracted towards the conducting body nearest to them, and not towards the source whence the power is derived. These powers of conduction seem to have no limits, for the electricity may be transmitted through insulated conductors to a distance of many miles, in an imperceptible space of time, without diminution. But though electricity will pass with such amazing facility through metallic conductors, it cannot make the least impression on non-conducting substances, which present a complete obstruction to its passage. The magnetic fluid, on the contrary, seems to possess the power of penetrating all bodies, though it attracts and is communicated to iron alone; and it seems to possess this property of passing through the particles of the closest bodies without having its effects retarded or impaired by their presence.

The property peculiar to the magnetic fluid of operating through solid, opaque, interposing substances forms one of its most curious features, and in this respect it differs from every other attracting power, with the exception of gravitation. The hardness of the intervening substance seems not to have the least effect on the energy of the attraction, and we find that when iron filings are strewed on a board, on a plate, or, indeed, on any other substance, not

too thick, and a magnet is held underneath them, the small particles of iron are immediately and strongly attracted, and the attractive force is as great as it would be at a similar distance were the interposing substance not there.

The division of the forces of the magnet into attractive and repulsive powers, its polarity, and the communication of its power to other pieces of steel, also exhibit phenomena that are not only inscrutable in their inherent causes, but whose modes of operation are inexplicable upon any presumed hypothesis. It is well known that when a magnet is suspended from its centre of gravity, one end of it will invariably turn towards the north, and whenever it is disturbed from that position, the same end will always resume that direction after the disturbing force is removed. If when a magnet is suspended freely in this manner the south pole of another magnet is brought near to its north pole, the two magnets will be strongly attracted, but if the north poles of the magnets be presented to each other, they will be as strongly repelled; and the north pole of the suspended magnet will turn away from the similar pole of the magnet presented to it.

These opposite forces of attraction and repulsion are strongest at the ends of each magnet, and diminish gradually towards their centres, at which points no magnetic power is percept-

ible. The central point, therefore, marks the division between the repulsive and attractive forces, and from either side of it the attraction and repulsion commences. Now, as the metallic bar of the magnet is formed of one uniform piece of steel, and as there exists no apparent obstacle to prevent the neutralisation of these two active powers, which have so strong an attraction for each other at the extreme ends of the bar, we are at a loss to conceive by what means these reciprocally attractive forces can be retained separate within the same piece of steel, when they have so strong an attraction in two different magnets. There is, indeed, some similarity between this phenomenon and that of a charged Leyden jar, but in the latter case the opposite electricities are separated by the thickness of the glass, the substance of which they cannot penetrate, and even in that case, when the opposite electricities are highly excited, they overcome the obstacles that separate them, and the jar is discharged.

The property of polarity is essential to the existence of the magnetic influence, and when a magnet is broken it instantly becomes two separate magnets, each one possessing two opposite poles. This is the case not only when a magnet is broken in the middle, but even when a small portion is broken off the end of either pole. Suppose, for instance, that we had a

magnet twelve inches long;—then six inches each way from the centre would exhibit opposite states of magnetism, which would increase in power to the ends of the magnetic bar. Now, if we were to break off one inch from the positive end, the natural inference might be that the whole of that fragment would exhibit positive magnetism; but instead of that being the case, the fragment immediately possesses two opposite poles; the fractured part becomes the negative end, and will strongly attract the end of the magnet from which it was broken, whilst the other end will repel it. After the original magnet has been thus shortened, the neutral point will be removed nearer to the negative end, and that point which, prior to the shortening of the bar, exhibited no signs of magnetism, will then become magnetic.

Now, if we imagine the opposite magnetic poles to be produced by the *plus* and *minus* states of magnetism at each end — like the opposite states of electricity — or whatever other hypothesis we adopt to explain the phenomenon, we shall find it involved in inexplicable difficulty. We perceive the magnet before it is broken exhibiting two apparently distinct powers, which could not exist in one and the same end without destroying or neutralising them both; therefore we must, according to all our preconceived notions on the subject, take for granted that the

magnetism at the positive end was either all *plus* or *minus*, or — if we assume the existence of two magnetic fluids — that it was composed entirely of the one kind of magnetism or of the other. If, then, the attraction of the positive end be caused by an excess of the magnetic fluid, the consequence that might naturally be expected to ensue from breaking off the part in which this excess was most concentrated would be, that the fragment would contain only an excess of the fluid. But, contrary to this expectation, we find the result to be that the part is no sooner separated from the whole than its two ends indicate opposite states of magnetism — the one being *plus*, the other *minus* — whilst the central point possesses no magnetic power whatever.

How the magnetic power in the fragment can divide itself into a positive and negative state it is impossible to conceive; for, as those two states possess a strong reciprocal attraction, and of course neutralise each other, even if we could form a conception of the manner in which they exist at the opposite ends of the same bar of steel, we should be still at a loss to understand how the magnetic fluid could, when a piece of that bar is broken off, collect itself in a state of excess at one end of the fragment, and leave the other end in a deficient state. The difficulty is increased by adopting the supposition that there are two distinct magnetic fluids; for in that case,

when a piece is broken off the end of a magnet — which, of course, must be charged with one kind of magnetism alone — the sudden appearance in that part of a different and opposite kind of magnetism would be utterly unaccountable.

The communication of magnetic influence to steel merely by contact, and not only without diminishing the power of the magnet which communicates it, but, on the contrary, with an increase of its energy, evidently shows that the magnetic power must exist previously in a dormant state, and that this action of the magnet on steel must, in some unknown manner, bring the latent power into action. The peculiar qualities of steel enable it, in some mysterious way, to retain the power that is thus communicated; but soft iron, though it exhibits magnetic phenomena even more strongly than steel whilst the magnet is continued to be applied to it, loses all its magnetic properties as soon as the magnet is removed. The retention of the power by steel must therefore be owing to some peculiar conformation of its particles, or to the carbon with which all steel is united.

Though iron and steel are nearly the only substances that exhibit magnetic phenomena, the magnetic fluid we must presume is capable of being conducted by and of pervading numerous other bodies; for we should otherwise be unable to account in any rational way for the

accession of magnetic attraction which supervenes on the contact of a magnet with steel. That the power must be derived from some extraneous source seems evident; for we cannot by any means conceive that the mere application of a magnet to the surface of steel generates the power. It must, therefore, be derived either from the bodies immediately communicating with the metals, or from the surrounding atmosphere. The whole process is, however, involved in the greatest mystery. We know that such a power as magnetism exists — that its sensible operations are confined almost exclusively to one metal — and from the general observations of those operations, connected with other phenomena of nature, we are led to infer, that the manifestation of this property is not caused by any new creation of power, but in consequence of bringing into action the dormant power by some exciting cause. The nature of the exciting cause we cannot explain, but we perceive the result of it is to endue steel with this peculiar property. This subtile property constitutes no essential part of the steel as a metal: it is in all respects totally distinct from it, and is a property superadded to its metallic character; which property, though imperceptible, excepting by its effects on iron, is an active agent, that appears to give a semblance of vitality to the metal. As the magnetic power is not created

by the exciting cause that imparts it to the steel, we must infer that it is not destroyed when the magnetism of the steel is impaired or altogether dissipated; and that, when the metal itself is consumed by rust, the same power which imparted apparent activity to its inert mass continues to exist in some latent form, and may be again brought into perceptible operation when the cause that previously excited it is renewed.

Some of the most marked distinctions between the phenomena of electricity and magnetism have been already pointed out, and if we assume magnetism to be a distinct subtile fluid, the nature of its union with grosser matter, and its existence independently of the matter which renders its properties cognisable to the senses, serves to add another to those instances previously cited, of the connection of matter with a distinct active principle that is not necessarily co-existent with the agent that brings that principle into action, even when its combination with that agent is the only form in which it is known to us. Should we, however, be disposed to accede to the opinion now prevalent among scientific men, that electricity, galvanism, and magnetism, are only different modifications of the same property of matter, in that case we must view the phenomena of magnetism as affording a peculiar and striking addition to the

illustrations of that mysterious, intimate, and yet independent, connection of the electric fluid with matter, which have been previously noticed. Again: if we should admit that the electric fluid is capable of undergoing modifications as important as those which distinguish it from galvanism and from magnetism, the consideration of the nature of those modifications in a subtile principle — itself unknown — which can completely alter its character and change its modes of operation, opens an additional vista in the boundless and obscure field of knowledge, through which we may behold further proofs of the insufficiency of the intellectual powers of man to comprehend even the material works of an omnipotent Creator; and may perceive the absurdity, therefore, of attempting to limit within the narrow capacity of the human mind, the operations of an omniscient Power, in the creation and modes of existence of the soul.

The phenomena of magnetism that we have been considering, become so familiar from frequent observation, that they cease to excite surprise; but let us for a moment conceive that the properties of the magnet were unknown, and that a traveller from a distant part of the world were to announce the discovery of the loadstone and its singular powers. Imagine, for instance, that he were to communicate, for the first time, that there existed a substance which

possessed an attractive power sufficiently strong to lift bodies many times exceeding its own weight, but that this powerful attraction was only exerted on iron; — that this peculiar force was not obstructed in its operation by the interposition of the hardest substances between the attracting power and that metal; — that this wonderful property produced not the least apparent variation in the bodies that possessed it, and that by mere contact it might be communicated to steel, not only without occasioning any loss to the original source whence the attractive power was derived, but with a positive increase to its energy by the communication of it to other substances. Let us suppose our traveller to state, in addition to these circumstances, that when this attractive property was communicated to a piece of steel, the two ends possessed different kinds of attraction, and that one would repel the end which the other attracted; that if this newly-discovered substance were broken into a thousand pieces, each piece would possess attractive powers, and the opposite ends of each fragment would possess opposite kinds of attraction; and, to conclude his tale of wonder, that if all the pieces were suspended freely, they would all point in the same direction.

We can readily conceive that the traveller who revealed this discovery would be overwhelmed with ridicule, and his statements would

be deemed scarcely more deserving of credence than those of Baron Munchausen. If the subject were thought to be worthy a moment's attention, there is not one of the alleged properties that would not be assailed by plausible arguments, founded on fallacious premises, that might serve for the construction of logical syllogisms to prove the existence of such a substance to be impossible. It is upon the same narrow system of philosophising, which presumes all things to be impossible of which the human faculties can form no conception, that the arguments adduced against the existence of the sentient principle in a separate state from that of the body have been principally founded. Every succeeding discovery, indeed, trenches upon the territory of presumed impossibilities, and shows that the operations of nature are not to be circumscribed by the limits which the ignorance of man would impose. But, regardless of these repeated checks on his presumption, he adheres to this narrow-minded system of reasoning, and will persevere in denying the possibility of states of being that cannot, from their inscrutable nature, be brought to the test of positive proof; though the arguments by which these objections are attempted to be supported are merely a repetition of those that have been previously refuted in the material world by the advancing progress of knowledge.

The consideration of the polarity and dip of

the magnetic needle might serve as additional illustrations, if any were necessary, of the inscrutable nature of this extraordinary property of matter; for in these phenomena we perceive that the magnetic influence, instead of being—as our acquaintance with its operations would lead us to believe — of very limited extent, manifests its energy, at the distance of thousands of miles, by means perfectly imperceptible and incomprehensible. The facts recently made known in the new science of electro-magnetism might lead us, again, into other paths of impenetrable darkness, if we attempted to explore their mysterious causes; but those phenomena already adduced are sufficient to prove that the properties of the magnet are beyond our comprehension; and it would only extend our observations to an unnecessary length were we to dwell on the numerous branches of the subject that might be advanced in support of our general argument.

CHAPTER XIII.

CHEMICAL ATTRACTION.

Some of the general phenomena of chemical attraction have been briefly adverted to in a preceding chapter *, but we shall now have to allude more particularly to this property of matter, for the purpose of showing the impenetrable obscurity in which it is involved.

The term Chemical Affinity, it has been previously explained, signifies the attraction subsisting between the ultimate atoms of different substances; and chemical action of every kind depends upon the exertion of the intimate and varying affinities in the molecules of matter.

In the consideration we shall now bestow upon this important chemical agent, our object will be to show that many of the effects produced by this property of matter are contrary to the inferences we might be supposed to draw from ordinary experience; that the cause of those effects is beyond the reach of the human understanding; and that, in the union of this subtile principle with the matter it controls, it exists independently of that matter: and hence to infer, first, that the results of experience in

* Page 5.

ordinary cases are not to be taken as the limits of possibility in questions relating to subtile properties; secondly, that as we perceive causes constantly operating in the material world, of the nature of which we can form not the least conception, it is not improbable that the still more inscrutable essence of the human soul may be capable of exerting its energies under circumstances that surpass our comprehension; and, thirdly, that the separate existence of this subtile property of matter, independently of the matter with which it is combined, affords a close analogy to the separate existence of the sentient principle distinct from the body which it animates.

To enable us to form an idea of the extraordinary nature of the process accompanying the commonest chemical phenomenon, it is necessary to divest the mind, as much as possible, from the impression that these effects are brought about by well-understood and extremely simple causes. The simplest chemical actions are those of solution and mixture; and we may, perhaps, imagine that no difficulty can attend the developement of their causes; but when we examine closely the extent of our knowledge even on these points, we shall find that, simple as they appear to be, we are quite ignorant of the modes by which they are effected, and of the nature of the causes that excite them; even

when we bring to our aid the light that has been thrown on the subject by discoveries in chemical science.

When, for instance, a few drops of vinegar are added to a glass of water, what can appear more natural or intelligible, at first view, than that the acid should diffuse itself through the water, and communicate to the whole a degree of acidity, proportionate to the quantity and strength of the vinegar employed? Again; when a lump of sugar is immersed in that liquid, what can appear more simple than its solution and disappearance, and its consequent communication of a saccharine taste to the whole of the fluid? But it will appear evident, on a very little consideration, that the combination of the acid with the water, and the solution of the sugar, which appear to be merely the necessary and passive consequences of their being brought into contact, must be effected by the operation of some active agent. For if the acid and the water did not possess some peculiar reciprocal attractive properties, the acid, as it is considerably heavier than water, would fall to the bottom of the glass; but instead of doing so, the heavier particles are suspended by the uppermost particles of the water, and their attraction must consequently be sufficient to counteract the gravitating force that continually tends to separate them.

The operation of an active agent in the chemical combination of liquids is rendered more apparent when sulphuric acid is employed, instead of vinegar, in the foregoing experiment. Sulphuric acid is nearly twice the weight of the water with which it combines, but its attraction for the water prevents the particles of the two liquids from separating; and, in addition to this indication of the presence of some active property which attaches the heavier to the lighter particles, we observe that the mixture of the sulphuric acid with the water excites a strong chemical action throughout the mass of the liquid; which then condenses into a smaller space, and liberates a large quantity of heat. The specific gravity of such a mixture is found to exceed that of the mean specific gravity of the two fluids; for if a pint measure of sulphuric acid be added to a pint measure of water, the result of the mixture will be very sensibly less than two pints, though the weight of the mixed liquids is undiminished. Some material internal action must consequently have taken place among the particles of the acid and water on their combination, which has condensed these fluids into a smaller space, though they are, in their separate states, scarcely compressible by the utmost mechanical power.

The same observation respecting the necessary presence of some active chemical agent will

apply to the process of solution. Unless there were some energetic principle at work to destroy the cohesive attraction of the crystallised particles of the sugar, it would remain a solid mass in water, as it does when in contact with turpentine, mercury, or air; but, by the influence of a mutual attraction between the water and the sugar, the particles of the latter are disseminated through the liquid, and enter into so close a combination with it, that they cannot be separated until some other chemical combination takes place, by the introduction of another substance that has a stronger attraction, either for the sugar or the water, than they reciprocally possess.

The property of chemical attraction appertains to all bodies, though they are frequently placed in circumstances not suited to its developement. When oil and water are placed in contact they exhibit no signs of possessing this power, and their particles, on the contrary, apparently repel each other; but they can, nevertheless, exert strong chemical attraction; and the cause of that property not manifesting itself in such circumstances is, that the peculiar attractions they respectively possess bear little or no affinity to each other. Oil and water may, however, be made to combine by the intervention of some substance to which they have separately an attraction. Soda, for in-

stance, which unites with water and with oil, will cause these apparently opposing bodies to combine. It is evident, therefore, that attractive powers were previously existing in the oil and water, and that they only required the presence of a communicating medium to bring those forces into operation. The comparative absence of chemical affinities in different bodies is, consequently, not to be considered as a proof of the want of chemical attraction in those substances, but merely to indicate that the reciprocal affinities are not sufficiently strong to overcome the cohesive attraction of their respective particles.

These considerations bring us to the next point of this interesting property of matter,—the existence of different kinds, or degrees, of chemical attraction. Not only do the particles of all bodies possess an inherent attractive property, but the nature of this attraction is different—or at least it operates with very different degrees of energy — among the particles of different bodies. It is upon these varying degrees of attraction that all chemical decompositions depend; for if their relative attractive powers were equal, no chemical change would take place when they were brought into contact: no one substance would possess a stronger attraction towards another than to the body with which

it is already united, therefore there would be no disposing cause to induce a change.

As an illustration of the effects resulting from bodies possessing different degrees of chemical affinity, let us take the following example: — If a small quantity of lime be immersed in diluted muriatic acid, the lime will be dissolved, and the solution will be perfectly colourless and transparent. A piece of potass added to the solution of lime will make the liquid turbid, and in a short time the lime will be precipitated to the bottom of the glass. This separation of the lime from its solution in muriatic acid is occasioned by the superior attraction which the acid possesses for the potass; therefore, as soon as the alkali is added to the solution, the acid separates from the lime and unites with the potass; and, as the lime is insoluble without the aid of the acid, it falls to the bottom. This property, which enables the particles of bodies to separate from previously existing compounds, and to unite with other substances, has been termed their elective affinity, from the choice which the combining substances seem to exercise in leaving one body to unite with another.

The cause of these varying degrees of chemical attraction is attributed to electricity; and in proportion to the quantities of the electric fluid contained in different bodies, and their negative or positive states of electricity respectively, their

affinities are supposed to be stronger or weaker. Those bodies that apparently possess no affinity to each other are presumed, according to this hypothesis, to be in the same state of electricity, and consequently to possess no reciprocal attraction; while those that possess the strongest affinity are supposed to be in opposite and strongly excited states of electricity, and the attraction is, therefore, in its greatest energy. But whether we regard chemical attraction as a distinct property of matter, or as only a modification of electricity, in either case we must consider it to be an active agent superadded to the particles of matter, and entirely distinct from them.

Another extraordinary peculiarity of chemical attraction is that exhibited in the definite proportions in which the atoms of different substances unite. Many substances, for instance, will only unite chemically in certain proportions; and whatever may be the disproportion of the quantities of them mixed together, chemical combination will take place between certain portions only of the two substances, and the surplus remains uncombined. Thus, we find that oxygen and hydrogen gases will unite chemically in those proportions only that constitute water, and that when a mixture of the two gases is exploded in a proper apparatus, if the proportions be not exactly those that form

water by their union, the superabundant gas will remain uncombined. In some cases, again, substances that unite only in definite quantities will combine in more than one proportion, though they will not unite in any intermediate quantities. Thus one hundred parts of manganese will unite with 14, 28, 42, or with 56 parts of oxygen; but only in those proportions, and in no intermediate ones. In the same manner, 14 parts of nitrogen will unite with oxygen in the proportions of 8, 16, 24, 32, and 40, but in no others; and when bodies unite in this manner in different proportions, those proportions always are, as in the preceding instances, multiples of each other.

We perceive therefore, from the foregoing brief statement of the laws which govern chemical attraction, that it is produced by some active principle which pertains necessarily to the atoms of material bodies; that this attraction between different substances varies in degree, even down to the point of apparent repulsion; and that, in many cases, where the power seems to be in the greatest activity, the combination between the attractive particles can only take place in certain proportions.

In whatever way we endeavour to explain the nature and operation of this property of matter, we shall find that it surpasses our comprehension. We may, indeed, by ascribing the effects of

chemical attraction to the agency of other powers, and by assuming certain arrangements to take place among the atoms of matter, imagine that we have a clear idea of the nature of the phenomena; but, on minutely examining the extent of our knowledge, it will be found that we have in reality made no advance toward elucidating the cause of chemical attraction; and that, allowing the existing theories respecting the cause of definite proportions to be correct, we should still be ignorant of the causes that dispose the particles of bodies to unite only in those proportions.

If, for instance, we ascribe the effects of chemical attraction to electricity, we do not make the least approach towards understanding its nature; for as we are avowedly ignorant of the nature of electricity, even when excited in its most palpable form, it cannot be supposed that our minds will become more enlightened on the subject by investigating it in its hidden recesses; when modified in a manner that completely alters its character and modes of operation, and prevents any one of its ordinary attributes from being cognisable to the senses. Again: if we were to adopt the atomic theory of definite proportions — which ascribes the operation of that law of chemical attraction to the union of a certain number of the ultimate elementary atoms of different bodies in the form-

ation of one atom of the new compound — we should still be equally unable to explain why the atoms unite at all; why the definite proportions of atoms always unite under given circumstances; or why the proportions are not indefinitely extended.

We shall next proceed to point out a few of those effects of chemical affinity which, if not subjected to the evidence of our senses, might, in consequence of their extraordinary deviation from the ordinary course of our experience, be considered to be impossible.

Muriatic acid gas and ammoniacal gas are both invisible, and a glass jar containing either would therefore appear to be empty; but when these two invisible gases are mixed, the muriatic acid unites with the ammonia, and forms a solid salt; and the sides of the glass vessel in which the gases are united is coated with white concrete muriate of ammonia. Without the evidence of this experiment, it would be impossible to conceive, *a priori*, that the mixture of these two gases could produce such a result; and if the fact were not capable of ocular demonstration, the formation of a solid substance by the mixture of two invisible gases might be deemed an impossibility.

If a bottle filled with ammoniacal gas be inverted over water, the water will immediately rush up into the bottle, and the gas will disap-

pear. The apparent effect will be nearly the same as if the bottle had been in a state of vacuum. This phenomenon is produced by the strong chemical attraction subsisting between the ammonia and water; in consequence of which, the former is immediately absorbed when they come in contact, and the gas, which was considerably lighter than atmospheric air, is thereby condensed into a liquid. The affinity of the ammonia and water is so strong, that the latter will absorb 500 times its own volume of the gas, and a pint of water will therefore be sufficient to liquefy 500 pints of the ammoniacal gas. This wonderful power of absorption is known to be occasioned by what is termed the affinity of ammonia and water; but of the nature of this attraction, or in what manner the gas can be thus suddenly deprived of its great elastic power, we cannot imagine.

Again; when solutions of carbonate of potass and muriate of lime are mixed in equal proportions, those two colourless fluids will be instantly converted into a white solid mass. The changes that take place in the mixture to produce this effect are as follow: — The carbonic acid that was combined with the potass has a greater affinity for the earth than it has for the alkali, and therefore leaves the potass to unite with the lime; and the muriatic acid, with which the lime was combined, having a stronger affinity

for the alkali than for the earth, it leaves the lime and unites with the potass. A double decomposition consequently takes place, and the result is, that two different solids are formed, viz. carbonate of lime and muriate of potass. In this experiment, it must be observed, though we are able to discover the nature of the changes that take place in the mixture, we are not able to discover the primary causes by which those changes are effected; and the conversion of two transparent fluids into an opaque solid substance, is so completely opposed to our notions derived from ordinary experience, that it has, not inaptly, been termed a chemical miracle.

When an infusion of tincture of galls and a solution of the green sulphate of iron — both colourless transparent fluids — are mixed together, they become black. If muriatic acid be then gradually added, the transparency of the liquids will be restored; but by the addition of a small quantity of colourless solution of potass, the solution will again become perfectly black. By a fresh addition of acid the transparency of the liquid may be again restored, and a further portion of potass will afterwards change it to black. In this case the tincture of galls unites with the sulphuric acid that holds the iron in solution, and liberates the metal in the state of a black oxide, which is held suspended in the

fluid, to which it imparts the property of absorbing all the rays of light. The addition of more acid redissolves the metallic oxide; and the further addition of potass attracts the acid from the metal, and causes it to be again precipitated. In these experiments we perceive that the effects are produced by the power of elective affinity in the acids, the metal, and the alkali, but in what that power consists, or by what means its operation causes the mixture at one time to absorb all the rays of light, and the next moment to transmit them through its particles, we can form not the least idea.

Examples of the astonishing effects produced by the operation of chemical affinity might be multiplied *ad infinitum*, but the few that have been selected are sufficient to show that the combinations induced by the agency of chemical affinity are too mysterious for the faculties of man to penetrate their causes, and that they are frequently directly opposed, in appearance at least, to the results of experience in the more common phenomena of nature. If, for instance, we were without positive proof of the fact that the union of two gases might produce an opaque solid substance, such a change seems so incompatible with our experience respecting the nature of gases, that it would not be credited. There are, indeed, several chemical processes, of an analogous description, in which a permanently

elastic aërial fluid is, by decomposition, made to form part of a solid compound. In those cases, however, there exists an original solid nucleus to which the base of the gas unites; but in the formation of a solid substance by the combination of two gases alone, there is no palpable nucleus around which the particles can begin to collect, and the analogy of oxides might consequently be regarded as insufficient to induce the belief that opaque, tangible, ponderous matter, could be created by the mere mixture of two invisible, subtile, and imponderable airs. But if the production of such an effect from causes so apparently inadequate might be deemed improbable, even though our conception of the combination were aided by the analogy which the composition of oxides affords, we must presume, that, if any analogous instance of the condensation of gases into solids were unknown, the formation of a solid body from invisible gases would be considered an absolute impossibility. We possess, however, experimental knowledge of the fact; the proximate causes of it are well understood; and the occurrence is considered as a natural result of the operation of certain undeviating affinities subsisting between the bases of the gases employed. It is an effect to the accomplishment of which the chemist looks with as much certainty as to any other anticipated result of chemical action; and that phenomenon which

persons unacquainted with science might consider miraculous, is in his view only the consequence of one of the established laws of nature, and its non-occurrence, in similar circumstances, would constitute the miracle.

It is thus that, in the progress of knowledge, phenomena which were once attributed to supernatural agency, are gradually discovered to be conformable to established laws. The investigation of these laws shows that the whole course of nature is regulated by fixed and unaltered rules; and man, having, as he imagines, discovered the principles that guide the complicated machinery, and proud of his attainments, he is unwilling to admit the possibility of any states of being that either militate against those principles which he conceives he has discovered, or that indicate the insufficiency of his system to explain the mode of their existence. Forgetful of the gradual steps by which he has risen from a state of ignorant wonder to his present position, and unable to perceive the immense height of the eminence above him, he is apt ignorantly to imagine that he has reached the summit of the hill of science, when he has only surmounted some of the obstructions surrounding its base; and it is only when obstacles to his further progress present themselves in forms which he feels his inability to master, that he becomes aware there is higher ground to be attained, and difficulties to be yet

encountered which his mental constitution cannot overcome.

It is with the view of keeping before our minds the limited state of our knowledge, and the consequent presumption of circumscribing the bounds of possibilities, that it is advisable to reflect upon the incompetency of man to comprehend the ultimate causes of any one of the phenomena of nature, and to call to mind the time when those effects that are now considered to be the necessary results of chemical attraction would have been deemed equally improbable as that presumed change in the state of existence of the sentient principle, which some sceptics now deny to be possible, because it is opposed to the laws which they have laid down for the guidance of an omniscient Power.

The chemical affinity of bodies may be entirely changed by combination with the particles of other substances whose reciprocal affinities neutralise their respective attractions; and it may also be materially altered by modifications of their mechanical forms; but though, in consequence of these changes, the original chemical affinities of the substances may appear to be destroyed, they will be found to exist undiminished notwithstanding their apparent annihilation.

When caustic soda and sulphuric acid, for instance, are mixed together, the result of the

chemical union of those two strongly corrosive substances is a perfectly mild salt — the sulphate of soda — commonly known as Glauber's salts. In this salt none of the peculiar characteristics of the acid or of the alkali can be distinguished. The tests usually employed to detect the presence of acids or of alkalies indicate the existence of neither of those substances in the salt; and the compound possesses characteristics in every respect different from those of its original elements. Most of those bodies to which the acid and alkali had previously a strong attraction may be mixed with a solution of the salt without any chemical action taking place to mark that such attraction ever existed. The original attractions are not, however, destroyed by their neutralisation in the salt, and when any substance that possesses stronger chemical affinity to the acid and alkali than the soda and sulphuric acid reciprocally possess, the dormant properties will be brought into action. Consequently, when a solution of nitrate of potass (saltpetre) is added to a solution of the sulphate of soda, the nitric acid in the former salt — which has a stronger affinity for soda than for potass — and the sulphuric acid in the latter salt — which possesses a stronger affinity for potass than for soda — exert their attractive powers, and, leaving the alkalies with which they were before respectively combined, each acid unites with the alkali to

which it has the stronger affinity; and the result of the change is the production of sulphate of potass and nitrate of soda.

As an illustration of the change in chemical affinities resulting from the change of mechanical arrangement, we may notice the fact that many substances which possess a powerful attraction for the alkalies and acids in their ordinary and pulverised forms, exhibit no affinity towards them when concentrated by the force of cohesion. Thus we perceive that potass, which readily acts upon powdered alumina (pure clay), has no effect upon that earth when it is condensed in a crystallised state in the sapphire and the ruby; and charcoal, which in its common form so readily combines with oxygen at a red heat, when it is crystallised in the diamond, resists the most powerful heat of the furnace.

In these illustrations, the power of chemical affinity is shown to be not destroyed nor impaired by the dormant state into which it is thrown by neutralisation and by the force of cohesion. In the first case, it is suspended, in consequence of its force being employed in retaining the union between the acids and the alkalies; and in the second case, it is prevented from coming into operation by the intervention of the counteracting force of cohesive attraction, which holds the particles firmly together and overcomes the chemical affinities that dispose the

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two substances to unite. These modifications and suspensions of the powers of chemical attraction present additional examples, to the many previously noticed, of the existence of an active principle in a latent state, when the usual indications of its presence are lost.

The brief consideration we have been enabled to bestow on the nature of chemical affinity has, it is conceived, been sufficient to warrant the conclusion that this property is an active, subtile, mysterious agent, distinct from the matter with which it is intimately combined, though our senses will not enable us to detect it in its disintegrated form. The exemplifications of the operations of this agent upon material bodies afford at the same time a rebuke to the presumptuous arrogance of man, for attempting to impose limitations on the works of Nature; — and its peculiar combination with matter presents an analogy to the presumed connection of the sentient principle with the human frame which, taken in conjunction with the other considerations attending the properties of chemical attraction, deserves to be regarded as an additional link in the chain of evidence to support our position, that the soul will exist after death in a state of separation from the body.

CHAPTER XIV.

GRAVITATION.

THE attraction of gravitation is an universal property of matter that pervades all known substances, and is in constant operation on every thing we behold. It is, indeed, so intimately connected in our minds with material bodies, that we seem to lose all idea of the presence of such a power as gravitation, and to consider its effects merely as the necessary results attending material forms. It affords in this respect another illustration of the fact to which we have previously alluded, that the mind may become familiarised with the operation of a constantly exerted power until the existence of that power ceases to be noticed, and an effort of the mental faculties is required to render us sensible of its presence. That a solid substance should fall to the ground when the supporting body is removed, and that the objects around us should rest on the floor, and not in mid air, seem to be circumstances so necessarily connected with the nature of those bodies, and we are so little accustomed to attribute such positions to the energy of any distinct active principle, that if solid bodies were not to be acted upon by the

attraction of gravitation we should ascribe such a departure from the ordinary course of events not to the suspension of any previously existing power, but to the superinduction of an active agent that sustained those bodies in the air.

It is only when the force of gravitation displays itself in a manner different from that to which we are accustomed, that our attention is drawn to the existence of such a power. The ascent of a balloon is the most striking apparent departure from the laws of gravitation; and when aërial voyages were less common than they have latterly become, those exhibitions naturally excited the greatest wonder. The ascent of a balloon, however, though apparently effected in direct opposition to the force of gravitation, is, in fact, produced solely by the operation of that power; for the rising of the balloon in the air is not caused by any positive property of levity in itself, but by the gravitation of the heavier air that surrounds it. A balloon, indeed, strictly speaking, does not *ascend*, for that term implies a positive and active power of raising itself, but it is merely *forced upwards* by the air of the atmosphere, the attraction of which to the earth being greater than that of the hydrogen gas within the balloon, the latter body is displaced by the superior gravitating power of the air. The balloon, which appears to be the active

agent in the ascent, is in fact completely passive, and is acted upon, and its motions are entirely directed by, the invisible atmosphere. The ascent of light bodies in liquids is caused in the same manner, by the pressure of the heavier liquid downwards, and the consequent forcing upwards of the lighter substance. That motion does not therefore depend, as is commonly supposed, on any principle of lightness in the ascending bodies; for every substance is attracted towards the earth by the force of gravitation, though the superior attractions of heavier liquid bodies may cause those possessing less specific gravity to appear to deviate from this general law of nature.

As no effect can be produced without a cause, we must admit the existence of some power that is enabled to attract bodies to the earth; for in whatever way we endeavour to explain the effects of gravitation, we shall be obliged to refer the cause to some agent that is capable of acting upon the inert masses of matter. We cannot, indeed, upon any other principle account for the attraction of gravitation; and though it seems inherent in all matter, yet it must be distinct from matter itself, which, according to our notions of it, must be inert, and incapable of exerting any active powers.

Though our familiar acquaintance with the commonly observed phenomena of gravitation induces us to believe that they are produced

without the exertion of any active principle, yet when this force is called into operation in a manner different from that in which we are accustomed to observe its effects, we are ready to admit that such effects could only be produced by an active agent, and we are lost in astonishment at the extent of its power.

In our ordinary observations on the effects of gravitation, we are accustomed to consider the earth as the grand depositary of this power; and as all bodies on the earth's surface are attracted towards it, we are not aware that the bodies acted on exert also an attractive power towards the earth. This is, however, the case; for gravitation acts upon all masses of matter reciprocally, and the energy with which it acts is proportionate to the respective masses; therefore, the earth is drawn towards a body falling to its surface in the same manner as the falling body is drawn towards the earth, and the force of their relative attractions corresponds with their relative quantities of matter. The magnitude of the earth, however, when compared with that of any detached body on its surface, is so immense, that its motion towards the falling mass is imperceptible. It has been calculated, that if the largest body that it would be possible to detach, were to fall from a height of 500 feet, the attraction which that mass would exert on the mass of matter in the globe would tend to move the

latter less than the 100,000,000,000th part of an inch.

Though the mutual attractions subsisting between masses of matter cannot, in consequence of the great disproportion between the earth and falling bodies, be rendered evident in general cases, yet in certain circumstances these reciprocal attractions become perceptible. It has been found, that when a ponderous body is suspended by a plumb-line from the top of a high mountain, it is drawn out of the perpendicular by the mass of matter in the mountain, which attracts the suspended body towards it. This attraction, because it is new to observation, we should be disposed at once to attribute to the energy of some attractive power between the mountain and the body attracted; though the stronger attraction towards the centre of the earth, to which we are accustomed, we are inclined to consider as effected without the agency of any power whatever.

If two bodies were launched into pure space, beyond the attraction of all other bodies, and were placed at perfect rest, millions of miles asunder, their reciprocal attractions would dispose them to approach each other, and they would approximate with a rapidly accelerating motion until they met, and they would then return to a state of rest.

That this mutual attraction would take place

between two bodies so situated is not a speculative supposition, but it is proved by mathematical calculations to be an undoubted truth, derived from the observation of the general laws of gravitation. Now we cannot conceive that two bodies, when placed at such an immense distance, could be mutually attracted, without supposing that the attracting power — whatever may be its nature — extends through space to both bodies; and that, therefore, there must be some property extrinsic to matter itself, which has the power of exerting this energy, distinct from, though intimately connected with, the bodies attracted. This property is the force of gravitation; — a power which we conceive to be so extremely simple when operating on the surface of the earth, and yet, when viewed in any of its relations with which we are not so familiar, seems to be involved in as much, or even in greater, obscurity than those other properties of matter to which we have previously directed our attention.

It is a question with philosophers whether all attractions are to be resolved into different modifications of the same general principle, or whether they are to be attributed to separate kinds of attraction, in their natures essentially distinct. The attractions of gravitation, of electricity, of chemical affinity, of cohesion, and of magnetism, are, according to the former of these

opinions, produced by the same acting cause differently modified. But if we take this view of the powers of attraction, we shall find the obscurity and mystery in which the subject is involved to be greatly increased, when, in addition to their single and yet incomprehensible natures, we add the consideration of those peculiar modifications — apparently equally mysterious with the elementary principle itself — which could produce such changes in that primary cause as appear to entirely alter its identity.

Another difficulty would also present itself in endeavouring to identify the attraction of gravitation with that of other attractive powers. The attractions of electricity, of magnetism, and of chemical affinity, are supposed to be exerted in consequence of the attracting bodies being placed in different states of electricity, &c.; and it is considered essential to the exercise of the power, that one body should be in a state of excess and the other in a state of deficiency; or, — according to the theory which supposes there are two distinct powers that mutually attract each other, — the attractions are caused by inducing separate attractive powers in the bodies that possess mutual affinities. The attraction of gravitation, however, could not be accounted for on either of these hypotheses, for it operates on all matter without regard to its composition, or to the varying affinities that may be

subsisting among the particles constituting the aggregate mass.

But even should we be disposed, notwithstanding the difficulty of reconciling the various kinds of attraction with each other, to assume that they are identical, we should not derive any additional knowledge respecting the nature of gravitation, as we are utterly ignorant of the nature of those attractions to which it would be compared. The attraction of gravitation, also, presents some features that appear to carry it farther, if possible, beyond the limits of our comprehension than the other attracting powers; for, in addition to the mysterious properties that give to bodies their power of attraction, we have in this case to consider the means by which the force of gravitation can be extended through the infinite bounds of space, uninterrupted in its energy by interposing bodies, and having no limits to its power in the vast range of creation. If the force of gravitation be calculated to excite our wonder, and if it surpass the bounds of our comprehension, when regarded merely in reference to its operations on the surface of the earth, the consciousness of the incapacity of our intellectual powers to grapple with so subtile a property, is greatly increased when we extend our views to the system of the universe, and behold the planets, with their revolving satellites, performing their evolutions round the sun,

sustained in their respective orbits by the same gravitating power that causes a pin to fall to the ground; — and when we farther consider that the solar system, vast as it appears, forms only a portion of the countless systems of suns and revolving planets in the boundless field of creation, that have their motions regulated by this unknown though all-pervading power.

It is the attraction of gravitation that, by continually controlling the motion imparted to the heavenly bodies, preserves them in their curvilinear orbits. Were they not attracted towards a central point by the mass of matter in the sun, they would, in accordance with the laws of motion, fly off into space; whilst the constant tendency of the revolving planets to move in straight lines, or at tangents to their respective orbits, is sufficient to counterbalance the attraction of the sun, towards which they would otherwise be directly attracted. These counteracting powers, which have been termed the centripetal and centrifugal forces — though the latter is merely a modification of the laws of motion by the operation of a controlling attracting power—are necessary to the maintenance of the system of the universe; and if either of them were to be withdrawn for a moment, the beautiful mechanism of the heavens would be immediately destroyed. If, for instance, the force of gravitation were to be suspended, all the

bodies impelled in curvilinear orbits would fly off at tangents, and move in independent and straight courses through the immensity of space. A vast scene of confusion would ensue, in which the moving worlds would be continually striking against and rebounding from each other. The objects upon their surfaces would be shaken off, and proceed independently in the directions in which they were first impelled, until they also came into collision with other masses, impelled likewise in straight courses, through the moving chaos. Or, if we suppose the impulse of motion to be withheld, the attraction of gravitation would then be exerted without a counterbalancing power; the planetary bodies would be attracted to the sun, and all the solar systems in the universe would be attracted towards each other, and form one immense aggregate of all the worlds and systems of worlds in creation.

If, therefore, any dependence can be placed on the conclusions drawn from the results of human knowledge, we must necessarily infer that the motion communicated to the planets at their creation and the attraction of gravitation were co-existent; or, at least, that the force of gravitation and planetary motion have been co-existent since the creation of our solar system: we must presume, also, that they will continue as long as the universe exists, and that the property of gravitation can be annihilated only by

the same omnipotent Power by which it was created.

The indestructibility of matter was deduced in the first division of our subject from the results of investigations into the nature of the various changes its forms undergo without destruction or diminution; and we thence inferred that, as matter is indestructible, the properties which characterise and control it must be equally imperishable. This inference, so far as relates to the property of gravitation, is fully corroborated by the foregoing considerations, which show that gravitation must have been co-existent with matter since the creation of the solar system, and cannot be annihilated without involving in its destruction that of the whole system of the universe.

The considerations that suggest themselves from this examination of the property of gravitation, bearing more immediately upon the object of the present work, are those which remind us of the inefficiency of the human intellect to comprehend the most apparently simple properties of matter, — those wherein the force of gravitation is shown to be actively operating under circumstances that appear to exclude the possibility of its presence, — and those which exhibit the prospect of its eternal duration. From the first of these considerations we may derive an additional lesson against ignorantly

presuming that phenomena, which to us are unintelligible, must therefore be impossible; from the second, we learn, that the difficulties which appear to attend the supposed existence of the sentient principle in a state of separation from the body, may find a parallel in the latent combinations of the properties of matter; and from the third consideration we may draw the inference, that if the attraction of gravitation, —which is a mere property of matter — be indestructible, the more subtile essence of the human soul, which animates the organised frame, is also imperishable and immortal.

CHAPTER XV.

GENERAL SUMMARY.

In addition to those properties of matter to which our attention has been directed, there are many others scarcely less interesting in themselves, nor less important as illustrations of our general argument. The attraction of cohesion, by which the particles of all solid bodies are held together; crystallisation, which disposes the particles of matter, under certain circumstances, to assume regular forms; the capacity of matter to take the impulse of motion, and to receive and communicate those peculiar vibrations producing sound, might be separately advanced in confirmation of those points which we have endeavoured to establish in this portion of our investigations. In each of these properties and capacities of matter we should perceive the agency of a power distinct from the inert masses to which those properties belong. The nature of the agent and its mode of operation would be found quite as inexplicable as those properties of matter that have received more especial notice; and its indestructibility, under all circumstances, when the original forms

and material organisations with which it was combined are destroyed, would be equally manifest. It would, however, extend this branch of our subject beyond its proper limits, to dwell more particularly on the different properties that operate upon and regulate material bodies, and we trust that the consideration already bestowed upon them has rendered such an extension of this subject unnecessary.

The objects proposed to be attained by this investigation of the properties of matter were, to exemplify by the phenomena that are continually presenting themselves to observation, the incompetence of the human faculties to understand the most simple operations of nature, and consequently to show the folly of assuming that the limits of our comprehension must be the bounds of possibility; to show, that the difficulties which have been raised against the presumed existence of the soul independently of the body are not greater than those which present themselves at almost every step in our endeavours to investigate the known properties of matter; and to point out, in the indestructibility of those properties and their separate existence from the matter they control, a striking analogy to the indestructibility of the sentient principle and its independence of the body.

In pursuance of this object we have taken under review some of the principal phenomena of

light, heat, electricity, magnetism, chemical attraction, and gravitation. The nature of these agents has been shown to be too subtile for the capacity of man to grasp. Whether they be regarded as one and the same property differently modified, or as distinct principles brought into action by different forms and dispositions of matter,—whether they be regarded as subtile material fluids, or as immaterial essences — whether they be supposed to operate by emission, or by vibration —whatever theory, in short, we adopt to explain their modes of operation, we are obliged to confess, after the utmost stretch of our intellects, that respecting the nature and action of any of these properties of matter we are profoundly ignorant. We are sensible of the existence of light, we feel the presence of heat, all the organs of sense bear testimony to the effects of electricity, and the attractions of magnetism, chemical affinity, and gravitation, are indicated in ways too manifest to admit a doubt of the existence of some power that acts upon inert matter, and imparts to it those peculiar properties; but if we attempt to penetrate the dark mazes in which those mysterious agents are concealed, we find ourselves unable to advance a single step, or to catch the faintest gleam to direct our course.

On examining the phenomena consequent on the exercise of those properties, their modes of operation appear to be not less difficult to com-

prehend than the nature of the acting principle. The dissemination of light, for instance — in which an infinite number of opposite rays must meet at every conceivable point, and be transmitted, nevertheless, without interruption, at an amazing velocity in all directions from the luminous bodies, to the bounds of space — though an unquestionable fact, appears to be so directly opposed to our experience of the laws of motion in material substances, that if it rested on less positive proof it would be considered absolutely impossible. The same difficulty applies in an equally forcible manner to any explanation that can be conceived of the radiation of heat; whilst in the effects of electricity in suspending chemical affinity, in the communication of the magnetic power, and the transmission of its attraction instantaneously through solid bodies, and in the formation of solids by the chemical union of invisible gases, we perceive similar instances of the apparent deviation from the ordinary course of experience which nothing less than positive demonstration would induce us to believe.

The third class of facts, however, to which our attention has been directed — relative to the existence of the properties of matter distinct from matter itself — is still more important. We have seen that the existence of light is not dependent upon the bodies which reflect its rays; that a sub-

stance which appears — so long as it is the subordinate agent for communicating light to the eye — to be the source of the light we behold, may be destroyed, and that yet there may be no diminution in the absolute quantity of that subtile property, though it is not perceptible to our visual organs after the removal of the reflecting agent. The phenomena of heat afford a beautiful illustration of the same fact, as they present that property at one time actually developed, at another latent, but in all its changes still existing undiminished and unaltered, independently of the matter which it modifies; always ready, under every circumstance, to be called into activity by the agency of chemical attraction. Electricity, magnetism, and chemical affinity, also afford clear exemplifications of their existence independently of the matter which they qualify. The active principle, or principles, of which those attractions consist is evidently something distinct from the bodies with which it is combined, and when that principle seems to be destroyed its powers are in reality in active though imperceptible operation.

All these subtile principles, and indeed every other property of matter, we must conceive to be of equal duration with the existing modifications of material substance; and, in the cases of gravitation and motion, to be coeval with the creation of the universe. In addition, therefore, to the

facts of the independent natures of the properties of matter, and of their continued existence in a different and imperceptible state when the forms with which they were combined are decomposed, we possess the knowledge of their having existed since the creation of the world; and we must therefore presume that these subtile, continuously existing agents can only be annihilated by the direct interposition of the Divine Power by which they were created.

The nature of the connection subsisting between the various properties of matter, which has been incidentally alluded to in the preceding chapters, forms also an important feature in the results of our investigations respecting their connections with material bodies. If, as we have in many cases assumed, the different properties of matter are distinct actuating principles, then their combinations with each other, and their consequent separations into their original distinct properties, afford a proof that not only is the union between grosser and more subtile matter capable of being dissolved, but that even the more intimate combinations which we must suppose to exist between subtile qualities may also be disunited, and separated again into their elementary principles.

The point we have been endeavouring to establish in this branch of our subject is, that

the phenomena of the material world afford evidence to prove that the belief in a future life is not only conformable to those phenomena, but that the natural inferences to be drawn from them lead directly to that belief; and that in all branches of physical science, presumptive evidence equally strong with that which can be brought to bear on this question would carry conviction to every rational mind.

If a person unacquainted with scientific researches were to deny the correctness of the discoveries of Sir Humphry Davy respecting the metallic nature of the earths and alkalies; or were he to deny that the combustion of two invisible gases could form water, merely on the ground that such results are contrary to his daily observation, and because he could not understand how such changes could be effected, he would undoubtedly be considered a most narrow-minded and irrational being; and yet the principal arguments against the immortality of the soul rest upon no better foundation than the incompetency of the human faculties to comprehend a state of existence separate from an organised frame. Upon the same principle, indeed, a man might doubt the exercise of volition, or even his present existence; for he cannot, by the utmost stretch of his intellectual powers, conceive the nature of either. I will, for

instance, to place my hand upon the table, and it moves there in obedience to my will; but why it should move there rather than to any other point within reach, or by what means the muscles are so contracted as to make it move at all, I cannot comprehend; — and still less am I able to understand how the will originated that caused the effect, or what is the nature of that faculty. We have a consciousness that this faculty resides in the brain, but there is nothing in the composition of that substance to induce the belief that it could possess such power; and we shall be obliged to confess that the brain is only the instrument of some superior subtile agent in the production of this effect. This subtile power we cannot comprehend, but we must admit that it exists, or we should otherwise deny the consciousness of our own existence.

Let us place the case of the materialists in the most favourable point of view, and suppose, for the sake of argument, that the sentient principle is a property of the organised matter of the brain, superadded to the properties in which the brain participates with all other matter, and developed only by that peculiar organisation; and even upon this supposition, we shall find that the evidence to be derived from the investigation of the properties of matter is directly favourable to the distinct existence of this imagined materialised principle, and of its continued entity after the

decomposition of the brain with which it is thus assumed to be united.

All philosophers admit that it is not possible for any forms or modifications of matter to be created out of nothing; consequently this hypothetical property presumed to be superinduced by the combination and organisation of other properties of matter, cannot, according to all received systems of philosophy, be a new creation. It must either be an effect produced by the combination of the other subtile agents that are intimately connected with material bodies, or it must be a distinct pre-existing principle which is brought into operation by certain organised forms of matter.

Whether or not it is in accordance with the known operations of the mind to consider it as only an effect produced by the combination of other elements, it is not within our province at this time to inquire. We shall now confine our view of this material hypothesis to the consideration of the proposed alternatives.

All our notions of matter represent it merely as an inert substance, capable of being acted on, but incapable of action. The properties which characterise matter, and the laws which govern those properties, are distinct from matter itself; and we must, therefore, in speaking of material organisations, bear in mind that these arrangements are not accumulations of inert particles,

but the organisation of a substance that is endued with certain active, subtile, and incomprehensible properties, that are distinct from mere matter, but are essentially parts of all its known forms.

It will appear from this consideration of the subject, therefore — even on the supposition of the sentient principle being an effect caused by animal organisation — that as the substances producing this effect must be the subtile agents that characterise matter, and not a collection of mere inert molecules; and as those subtile agents have been shown to be distinct from the matter they control, and are indestructible, consequently the product of their combined arrangement must also be presumed to be distinct from inert substance and imperishable. And though this supposed material product is only appreciable by our faculties when it is combined with and acting upon matter, we must conceive that it would be capable, like the simple subtile agents of which it is compounded, of existing independently of the material frame it animates.

Were we to take the other alternative, and to assume that the sentient principle is an elementary material property developed by a certain organisation, in that case, as we cannot suppose any simple material substance to be created by any possible combination of other material bodies, we must come to the conclusion that this sup-

posed elementary material property was pre-existent, and that the effect of the complicated organisation was only to develope and not to create it. And again; as all the other properties are distinct from the matter to which they impart their respective powers, we cannot refuse to admit that a property so infinitely more subtile and incomprehensible in its nature — which imparts the powers of sensation and volition — must participate in this independence, at least in an equal degree, with those other properties of matter which are subservient to its will.

Whether, therefore, we view the sentient principle merely as a property belonging to a certain combination of other properties of matter, or regard it as an elementary principle developed by organisation, we shall be forced to admit that it is in either case distinct from the organised system in which it is manifested; that it is, like those subtile agents, capable of a separate existence, and like them, too, imperishable. This view of the question is, indeed, in all its practical bearings, nearly similar to that which considers the sentient principle as an immaterial essence connected temporarily with a material frame; for the subtile properties of matter are so far beyond the limited comprehension of the human faculties, that we must grant it — even on the material hypothesis — to possess nearly the

same attributes which are conceived to belong to immaterial essences.

We know that there is something in matter which imparts to it active properties distinct from matter itself; and we feel conscious that there is something in the human frame which directs its material organisation, superior to its arrangement of material particles. The investigations we are enabled to make into the nature of the former properties lead to the conclusion that they are distinct from matter, and equally imperishable with material substance. The same powers which we have ascertained to belong to the properties of matter must, as we have before observed, belong to the sentient principle, whether we conceive it to be constituted of a combination of those properties, or to be a distinct material agent rendered perceptible by that combination; and the power of eternal duration must, almost necessarily, appertain to the living principle if we conceive it to be an immaterial essence presiding over and governing the actions of the material frame.

PART III.

THE PHENOMENA OF LIFE.

CHAPTER XVI.

PRELIMINARY OBSERVATIONS.

We have hitherto considered matter and its properties in their simple inorganic states. We shall now have to view them in those more intricate combinations and arrangements wherein they develope qualities different from those of their elementary forms, and by the agency of which the functions of vegetable and animal life are discharged.

The facts supplied by the investigations of physiological science have furnished some of the most powerful arguments in support of natural theology. Proofs of design, of wisdom, and of benevolence, are displayed in every branch of the inquiry; which exhibit, in the clearest manner, the presence of an omniscient Creator. It is not, however, within our province to expatiate on this subject, as it is assumed that we are acquainted with and appreciate the evidence on which the belief in the existence of a su-

premely wise, powerful, and benevolent Creator of the Universe is founded. It is our peculiar duty to inquire whether the complicated organisations of matter that manifest so clearly the existence of an intelligent creating Power, do not also afford evidence to prove that the living principle, which preserves and directs those organisations, is distinct from organic matter, and that it exists in a separate and imperishable state.

The intimate, and apparently necessary, connection between the mind and an organised frame, constitutes, it is true, one of the strongest grounds on which the system of materialism is founded; and physiological investigations have, therefore, been considered unfavourable to the argument of the separate existence of an immaterial principle. The dependence of the condition of the mind upon the state of the body, — its depression when the body is subject to disease, — its vigour when the animal machine is in perfect order — and the corresponding decay of the mental faculties with those of the corporeal frame with which it is united, — have served as the foundations for inferences and supposed analogies, drawn from partial and limited views of those phenomena, that will not, it is conceived, bear the test of examination.

Were the world to be formed of matter and its properties in the simple states in which we

have hitherto considered them, the face of nature would present the appearance of a lifeless desert. Not a blade of grass would spring from the ground. neither would any living creature move along its surface, nor swim in its waters. The tides might, indeed, ebb and flow; the rocks might gradually crumble into dust by the decomposing influence of the atmosphere; the aqueous exhalations might rise into the air, be formed into clouds, and be again returned to the earth in showers; and day and night, winter and summer, might continue to roll on in endless succession; but the moving ocean, the accumulating soil, the abundant showers, and the changing seasons would benefit nothing; these wonderful manifestations of design would have no object, and the earth would exhibit a barren waste, moving in dreary solitude in its orbit round the sun.

We have now, however, to view the arrangements of matter in forms suited to the developement of living principles; for the germination, growth, and support of which the whole material world seems to have been formed; and for the promotion of which purposes it is so admirably adapted.

From the first discernible trace of vegetable organisation in the fungus, through the innumerable gradations in the scale, until we arrive at the mighty oak of the forest, two leading

principles seem invariably to characterise those forms of matter — their powers to provide for their own nutriment and growth, and to propagate their species. These powers seem indispensable to every form of organisation, and it is these properties that distinguish an organised system from the arrangements of crystallisation. As we ascend in the scale, from the vegetable to the animal kingdom, we find that to these two essentials of organisation are added the powers of sensation and volition; and in the highest range of animal life, we find the mental faculties of thought, memory, reflection, reasoning, &c. which distinguish a rational being from the brute creation.

It will be our province, in the following pages, to show that this living principle in plants, and the sentient and thinking principles in man, are distinct from the organised structures in which they are developed; and that they are not inherent in any portion of the matter which composes those organisations. We shall also endeavour to prove, from facts and illustrations derived from an examination of the exercise of the perceptive and mental faculties, and the corporeal functions, that the sentient principle is not only distinct from, but may, and does exist, independently of the material organisation of the body.

The obvious and latent analogies, also, that

are presented by the phenomena of the growth, the decay, and the dissolution of vegetable and animal life, to the presumed separability of the sentient principle from material organisation, will, it is believed, in our view of the question, be found to counterbalance those of an opposite tendency that are advanced by the advocates of materialism. The phenomena of life will therefore furnish not only a refutation of the arguments on which the system of the materialists is founded, but it will afford direct positive evidence of the distinct nature of the living and thinking principle, and of its continuing to exist in a future state of being.

CHAPTER XVII.

VEGETATION.

The consideration of the germination, growth, and economy of plants forms one of the most interesting subjects that can occupy the attention of the philosophical inquirer, though the complexity of the simplest arrangement of organic matter, and the obscurity of the ultimate causes of vegetation, involve the inquiry in apparently impenetrable mystery. The causes which impel a seed, when buried in the ground, to send forth shoots into the earth and others above the surface; and the means by which the moisture, which the former imbibes, is decomposed and made to contribute to the growth and nourishment of the rising plant, have not been, and perhaps never will be, satisfactorily developed. The researches that have been directed to this intricate branch of science have, however, thrown considerable light upon the curious process which these hidden causes induce. We cannot, of course, enter here into a minute detail of this process, but it will be sufficient for our purpose to take a brief survey of the leading phenomena of vegetation, as a

groundwork for those inferences which it is contended are to be reasonably drawn from their consideration.

Though the seeds of every species of plants have distinguishing characteristic differences, yet there are some general properties in which they almost invariably agree. Each seed contains within the outer rinds that envelope it the latent germ and radicle; — the latter intended to strike into the earth, and the former to sprout above the ground, and to grow and flourish as the future plant. When the seeds are placed in circumstances favourable to their germination — that is, when they are surrounded by moisture accompanied with a certain degree of heat — the outer rind, which is in immediate contact with the moisture, begins to ferment; or in other words, to enter into a chemical combination with the elements of the aqueous particles. The water and the rind are mutually decomposed, and the elementary substances are conveyed through the porous vessels of the seed to the radicle and plumula, where they are converted into vegetable matter, by the agency of some unknown principle; and the germ, being thus enlarged, bursts through its envelope. The substance of the seed, whence the first nutriment is derived, continues to nourish the germinating plant until the roots have acquired sufficient size and power to furnish the requisite quantity

of aliment. The roots then branch out into the ground, and imbibe from the earth through their minute orifices, the moisture which is afterwards converted, by some hidden process, into the juice that forms the sap of the plant. This sap is forced upwards, by the same unknown agency, through the minute vegetable fibres. The nursling sap stimulates the developement of the leaves, which then act as the digestive organs of the plant in assimilating this food, to form its appropriate nourishment. The juices thus prepared, and loaded with carbonaceous matter, imbibed by the leaves and by the roots, deposit a portion of their contents as they traverse the vegetable fibres, and augment the substance of the plant; whilst the continued stimulus of the rising sap forces out additional branches, with their accompanying leaves, until the stem and branches become sufficiently large to appropriate to their nutriment the whole of the secreted juices.

The foregoing is an outline of the general phenomena attending vegetation, but the results of the process vary, according to the nature of the seed, from the tender, beautiful, and fragrant flower, to that of the hardy tree of the forest. By the assimilation of the circulating sap, the fibrous woody substance of the stem and branches, the bark, the leaves, the flowers, the fruit, and the seed that is to form other

similar plants, are all produced: but in what manner the sap is secreted and forced upwards, how it is altered in its character by the leaves, by what means it can, when thus changed, be converted into an organised system of woody fibres, and those fibres be extended into other branches, surrounded by bark and bearing leaves, blossoms, and fruit; or what is the nature of the change that can cause the same fluid which circulates through and is converted into the branches of trees, to form in one part flowers and in another part fruit, we can form no conception.

The products of vegetation, also, compared with the substances of which they are composed, form a subject for consideration not less curious than the process of vegetation itself. We are so accustomed to the growth of trees and plants, that the extraordinary difference between the source whence they derive their nourishment and the products of vegetation seldom attract observation, though a little reflection will convince us that it is a subject calculated to excite the greatest astonishment.

The principal food of plants is water, and the results of several experiments seem to lead to the conclusion that water is the only nourishment absolutely necessary to their radical growth. But allowing that the carbonaceous properties of the soil are essential to the growth of most trees,

and that the elements of which they are composed are to be found in the earth and the surrounding atmosphere, what feature of similarity can be traced between the flourishing tree and the ground whence it springs? or between the soil and the fruit on its branches? The fibres and orifices of the roots of plants are so extremely small, that it is impossible the nutriment can be conveyed through their pores in any form more dense than a liquid. The liquid is decomposed in passing through the plants; and after the elementary substances have been re-arranged, they are forced to those other parts where the nutritive fluid undergoes further changes, until, by the peculiar action of the vegetative principle, the liquid originally imbibed from the earth becomes a part of the vegetable organisation, and forms a portion of a substance totally dissimilar, in all its appearances, characteristics, and properties, from that whence its elements were derived.

If we conceive it possible for a person who has attained his reasoning faculties to be ignorant of the effects of vegetation, such a person, on being shown for the first time a tree laden with fruit, or a beautiful fragrant shrub, would have no more idea that the tree or shrub was necessarily connected with and was formed out of the ground, than a person who for the first time sees a steam engine or a ship has that

those objects are growing out of the ground or the sea. The dissimilarity between a lump of moistened earth, and the products of vegetation, is, in fact, as great as it is possible to conceive any difference between two objects; and were it not for our experience of the fact that trees, fruits, and flowers, derive the greatest portion of their substance from the ground, it would, we have little doubt, be considered an absolute impossibility, that the green herbage, the organised woody fibre, the beautiful, variegated, and fragrant flower, and the delicious fruit, should be composed of matter bearing not the slightest trace of resemblance to the soil, — a substance which cannot be converted by any known chemical process into animal food. By means of chemical analysis, however, we are enabled to ascertain that the elementary substances of all vegetable products are contained within the earths, water, and gases from which plants are known to derive their nutriment; though we are not able to combine those elements in any manner that would produce even an approach to the same results.

The principal constituent parts of all vegetable products are hydrogen, carbon, and oxygen; — the other ingredients form so trifling a portion of their composition as scarcely to deserve notice. Those three simple elements, combined in different proportions by the hand of Nature,

constitute the solid substance and the liquid juices of all grasses, plants, trees, flowers, fruits, and seeds; and in the process of vegetation they are extracted from the soil and from the atmosphere, and are converted by the vegetative functions of the plants into those various products.

We thus make an important step in advance towards the knowledge of the principles of vegetable physiology. We learn that the growth of plants, and the production of flowers and fruits, are not occasioned by a new creation of matter, but by fresh combinations of the existing elements, and by their arrangement in certain forms. Had we not possessed these means of ascertaining the composition of plants, the conversion of a quantity of soil into vegetables would in all probability be positively denied. By the science of chemistry, however, we discover that the effects of vegetation can be only caused by this assimilation of the elements of the bodies submitted to the vegetative process; and we are thus furnished with an additional illustration of the fact that the extension of our knowledge opens a wider range of possibilities, and affords evidence of the existence of operating causes capable of producing effects that are completely incompatible with external natural appearances.

In the two states of ignorance which we have

just assumed, viz. that of a person unacquainted with the effects of vegetation, and of one ignorant of the rudiments of chemistry, the difficulties that would present themselves in endeavouring to discover the phenomena of vegetation would be insurmountable. If, for instance, a person who had never witnessed the effects of vegetation were to be told that when a seed is sown in the ground, it shortly puts forth a green shoot from the earth, and gradually increases into a strong woody stem, which sends out branches covered with leaves, and bears flowers that afterwards turn into fruit; and that the latter contain numerous seeds, each of which is capable of undergoing the same process, and of also becoming a similar tree, he would naturally conclude that the whole story was only an ingenious fable, and, to him at least, the existence of the sentient principle after death would appear a much more probable supposition than the circumstances narrated respecting the vegetative process. Supposing, however, that his doubts were removed by seeing the phenomena attending the germination and the maturity of plants; he would then be equally incredulous respecting the formation of the tree and the fruit, from the elements of the soil and the air; until those doubts were also removed by an acquaintance with chemical processes. But having attained this knowledge, where is he to apply

for an elucidation of the nature of the mysterious power by which the vegetative process is commenced and carried on? It surpasses the science of chemistry to discover the principle of vegetable life, which exists in the seed before it is sown, which attracts the nutritive elements as it germinates, and disposes them in the forms adapted to the proper augmentation of the plant; and which, after the roots are formed, extracts the nutriment from the ground, forces the sap through all the minute pores, developes the leaves, the fruit, the seeds; and, whilst its action continues, preserves the vegetable matter from destructive decomposition. Our inquirer finds that he has reached the extent of human knowledge on this subject, and that, after detecting a number of secondary causes, he must at last refer the ultimate cause of vegetable life — which regulates those secondary causes he has discovered — to some hidden principle, the nature of which he cannot ascertain, and which no human being can comprehend.

If our inquirer exercise his reasoning powers in reflecting upon the advances he has made in the discovery of the causes of effects which he at one time considered impossible, he will learn to place less confidence in his own ability to unravel the mysteries of nature, and he will be inclined to believe the possibility of other phenomena, though their causes and modes of oper-

ation may be inconceivable; and when he finds, in addition to those extraordinary processes of vegetation with which he has become acquainted, that matter is indestructible; that all the properties of matter are subtile essences distinct from matter itself, and also imperishable; and that to those properties, when combined in vegetable organisation, there is added some other unknown subtile principle, which appears to regulate the whole—he cannot fail to admit that the existence of the sentient principle independently of the body in which it is developed, seems to be not only equally possible with those concomitants of matter, but even more reconcileable with his present views of natural phenomena than those facts with which he has become acquainted, are with his former ideas respecting them.

The foregoing illustration of the inferences to be drawn from the phenomena of vegetable physiology is only one out of numerous instances that might be adduced, and of which the memory of every individual will furnish examples, to show that as our knowledge extends, the bounds of possibilities enlarge; and that facts which we now feel convinced are indisputably true were considered, in an earlier stage of acquirement, to be impossible: and we may fairly conclude that, in a more advanced state of science, many of the difficulties which still surround the investigation of natural phenomena would disap-

pear; and that if our mental faculties were extended, the more subtile properties of matter, and the nature of their connection with material bodies, which subjects now surpass our comprehension, would be clearly manifested. The recollection of the progressive stages of our knowledge, and the consideration that what we at present have acquired is but a small portion of what is yet to be learned, and that when we have attained the utmost bounds of human wisdom there are innumerable objects of research which the intellectual powers of man are incapable of grasping, cannot be too frequently recalled to mind, for the purpose of checking the vain presumption, so irreconcileable with sound philosophy, that all supposed effects which are incomprehensible to our limited faculties must be impossible.

In our notice of the phenomena of vegetation we have, as yet, considered principally the chemical actions and decompositions which contribute to that process. When, however, we carry our chemical researches to their farthest extent, we find that there is still wanting a cause to account for the active force that distributes the nutriment extracted from the earth and the air to the requisite parts of the plants, and for the proper disposition of the digested materials into woody fibre, leaves, flowers, fruit, and seed. This cause, which lies dormant in the seed until brought into action by heat and moisture,

is not to be ascribed to any known chemical action, nor to any known property of matter; and we are obliged to refer it to some latent principle that is developed by chemical attraction, and is yet distinct from it. This latent power has been denominated the living principle of plants, and it bears indeed a close analogy to the vital power which regulates the functions of the animal frame.

We are unable to discover the nature of this living principle, but we are obliged to admit that some power beyond mere chemical action must preside over the vegetative process, capable of arranging the products of decomposition into such curiously complicated and beautiful forms, and of protecting the plant from the action of the oxygen of the atmosphere, and from undergoing destructive fermentation, which it quickly does when the living principle is lost. This principle must be contained in the seed, and be afterwards diffused through the whole vegetable; and it must be presumed that it is either distinct from all the other properties of matter, or is produced by some peculiar combination or modification of those properties.

We know so little, indeed, respecting the nature of the properties of matter and their powers of combination, that it would be presumptuous to assert that the processes of vegetation could not be developed by their united efforts; but to

produce these effects their powers must be exerted in a manner different from any that is known to us; and there seems to be less difficulty in conceiving that the vegetative principle is a distinct elementary subtile property, than in supposing it to consist of a combination, or modification, of the other properties of matter; not one of which — so far as our knowledge extends—possesses any power capable of producing effects analogous to those of the vegetative process.

Whether we consider this power as a distinct principle, or as the effect of the combination of the properties of matter, the conclusion respecting the subtile nature of the agent will be the same. For if we adopt the former opinion — that the chemical processes and adaptations of vegetation are carried on under the guidance of an elementary controlling power—as this power is neither matter itself nor one of the known properties of inorganic matter, it must be something distinct from both; and we must reasonably conclude, from the circumstance of its being endued with a directing power over the ordinary properties of matter, that it is not inferior to them in their general attributes of extreme subtility, pre-existence, and indestructibility. All attempts to comprehend the nature of this principle seem to be even more futile than our endeavours to give a fixity to our ideas respect-

ing the nature and operation of light, heat, gravitation, &c.; and we can scarcely conceive of it otherwise than as an extremely subtile essence embodied in plants, and connected temporarily with their material organisation; of which it is the cause, and not the effect.

If, on the other hand, we adopt the hypothesis that the process of vegetation is produced by the operation of the combined properties inherent in different forms of matter, then, in that view of the question, as those properties are singly imperishable and pre-existent, those essential attributes must consequently be imparted to the supposed compound.

It may, perhaps, be objected—on the supposition of the vegetative principle being a compound, or modification, of the other properties of matter—that as this peculiar modification is only perceptible when connected with an organised system, it may be caused by, and depend altogether upon, the organisation of matter; and that when that organised system is destroyed, it may be dissolved. But, if we reflect a moment, we shall find that this objection is founded upon the illogical basis of transposing cause and effect; and would involve the absurdity of attributing a cause to an effect, instead of ascribing the effect to its cause.

We have before observed, for instance, that the phenomena of germination and vegetation

are produced by the conversion of the moisture of the soil and the elementary constituents of the air into proper nutriment for the plants, first by the decomposition of the outer coats of the seed, and afterwards by the action of the roots and the leaves. This process we may conceive to be produced by the agency of chemical affinity, though we cannot discover its modes of operation. We might conceive it possible, also, that after the juices of the plant have been formed they might be circulated through its pores by some unknown modification of galvanic attraction. But we cannot conceive it possible for either of those powers, or for any combination of them or of the other known properties of matter, to be capable of converting those juices into constituent parts of the living organised system; — each part when added to the plant taking a share in the processes of stimulating the circulation of the sap, and of still further augmenting its growth. These processes, it must be observed, are essentially different from that of crystallisation, to which they bear the nearest analogy, inasmuch as in the latter case the particles that obey the laws of crystallisation, though they are deposited in regular forms, constitute only portions of an inert mass; and do not contribute, further than by the amount of their own quantity, to the augmentation of the crystallising body. In the vegetative process, on the contrary, each

particle that is deposited exerts an active influence in promoting the growth of the plant, of which it constitutes a portion.

To whatever cause, however, we attribute the principle of vegetable life, we shall be obliged to admit that the cause must exist before the effect can be produced. The decomposition of the moisture and the air, for instance, could not take place unless the chemical attraction between the elements of the substances decomposed previously existed; nor could the sap circulate without the previous presence of the agent that communicates the motion; nor could the smallest particle of vegetable matter be organised without the agency of some previously existing cause. If, therefore, the living principle in plants be produced by the combination, or modification, of the properties of matter, that combination or modification must be prior to the resulting organisation; and cannot be dependent upon the system of organisation which it produces. The objection, consequently, that we presume it possible might be raised upon this consideration of the nature of the vegetative principle, falls to the ground; and whether we regard this principle as a distinct subtile essence, or as a modification of the properties of matter, on either supposition we arrive at the conclusion that it must be pre-existent, imperishable, and distinct from the organised system of

matter by means of which it becomes perceptible to our senses.

The appearances presented by the phenomena of vegetation have been often advanced by various writers as analogous to the resuscitation of the human soul after death. The fall of the leaves in autumn, and the apparent absence of vegetable life during the winter months, have been, not inaptly, compared to the decay of age, and the sleep of death; whilst the renewal of the vital energies in the spring, and the restoration of the pristine vigour and beauty of vegetation in the summer months, have been regarded as symbolical of the resuscitation of the sentient principle in a new and invigorated state of existence. These curious and wonderful external phenomena of vegetation are, indeed, beautifully emblematical of a future life; but they cannot, when taken abstractedly, be considered as bearing a complete analogy to the separate existence of the sentient principle; for, notwithstanding the periodical renovation of the dormant vegetative principle for a series of years, a time at length arrives when the decaying organisation refuses to perform its functions, and when the returning spring ceases to restore life to the withered trunk and the leafless branches. The tree is then dead; and all appearances indicate that the principle by which this vegetative process was carried on is irrecoverably extinct.

If, therefore, our observations were confined to the external phenomena of vegetation, the analogy between the renovation of vegetable life and the reanimation of the sentient principle in man would be inconclusive; but when we carry our views beyond these mere outward changes, and consider the nature of the process by which those phenomena are produced, the hiatus is supplied, and the analogy becomes complete. We learn, from this view of the subject, to regard the living principle of the tree as distinct from the vegetable organisation, which the energy of that principle produces; and to consider the destruction of that system of organisation only as the disarrangement of certain forms of matter by which the living principle was for a time developed, without involving, in the least degree, the destruction or diminution of the energy of that subtile essence.

The phenomena of vegetation, it will be observed, on a general view of those particulars we have noticed, afford three species of evidence in support of our argument. In the first place we learn, from the incomprehensible nature of the process, to appreciate the insufficiency of the objection that has been urged against the separate existence of the sentient principle, founded on the want of capacity in the human intellect to apprehend such a state of being. In the second place, those phenomena

afford additional evidence of the existence of a subtile, imperishable principle distinct from matter, and existing prior to, and independently of, its organisation. And, thirdly, the external appearances combined with the more latent processes of vegetation, when viewed as conducted under the guidance of the vegetative principle, present a perfect analogy to the continued exercise of the sentient and thinking principles of man after the decay and dissolution of the corporeal frame in which they are developed.

CHAPTER XVIII.

ANIMAL ORGANISATON.

THE distinctions between inorganic matter and vegetables, and between the latter and animals, are, that the first simply *exist*, that vegetables exist and *live*, and that animals exist, live, and *feel*. It has, indeed, been maintained by some philosophers, that the vegetable creation is endued with feeling; but though certain plants exhibit, by shrinking from the touch, and by their locomotive powers, some indications of life, yet those indications are to be accounted for by the operation of chemical and mechanical causes without the necessity of supposing them to possess sensation. It must be admitted, however, that between the lower grades of animal life and the sensitive plants the difference is not great, and it becomes difficult to ascertain the precise point where mere vegetation ceases, and where animal life begins.

Zoophytes partake in many respects of the nature of vegetables, and their sensations, we must conceive, cannot be very acute; but they nevertheless possess some distinctive character-

istics, which sufficiently distinguish them from the vegetable creation.

In addition to the signs of sensation which they evince in shrinking from approaching danger, zoophytes exhibit indications of volition in their modes of securing and consuming their food. Their organisation also differs materially from that of plants. The latter receive their nourishment from absorbents opening externally, which possess the power of changing the character of the food before it is introduced into the body of the plant. Zoophytes, on the contrary, possess an intestinal canal into which the food is introduced in its natural state, and the processes of digestion and absorption are performed internally. These may be considered to be the principal distinguishing marks between the lowest order of animal life and vegetables.

The next advance in the scale of animated creation presents us with the first trace of a nervous system, of which the zoophytes afford no indications. In worms the nervous system consists of filaments of nerves, which extend along the whole length of the animal, and are united at several points into knots or ganglia, which constitute distinct centres of sensation. This organisation presents the first approach to the spinal chord. Insects, fishes, birds, quadrupeds, and man are furnished with brain, of which the lower orders of animals are destitute.

The brain is distinct from the nerves, and the latter seem to be merely ramifications from the former to the different portions of the animal frame. The higher we ascend in the scale we find that the proportion of brain increases, and in man — the most perfect of all animals — the quantity of brain is greater, not only in relation to his comparative size, but absolutely greater than that in any other living being, with the exception of the elephant.

The animal kingdom was divided by Linnæus into six classes, according to what he conceived to be marked distinctions in their internal structure. These classes are thus distinguished: — animals that suckle their young, birds, amphibious animals, fishes, insects, and worms. The leading anatomical characteristic that seems to separate the animate from the inanimate creation — the nervous system — is, however, common to all, with the exception perhaps of the zoophytes; and possibly on further investigation it will be discovered that they also are not destitute of those organs of sensation. In the following observations, however, we shall confine ourselves almost exclusively to the organisation and functions of the human body, which is the most perfect of the organised arrangements of matter.

The groundwork upon which the human frame is constructed, consists of a series of differently shaped bones, adapted to each other and joined

together by ligaments. This bony structure gives firmness and shape to the form, and serves not only as a solid support to which the muscles and other membranes are attached, but is eminently useful in affording protection to those delicate parts of the frame which require to be guarded from external injury. The muscles, which are the organs of motion, compose a great portion of the fleshy parts of the body. Their fibres are extremely minute, and they are united in different forms. Through the muscular substance arteries, veins, and nerves are ramified in infinite numbers. The fibres of the muscles are contractile, and when excited by the nerves they immediately shrink, and cause the bones to which they are attached to move. The irritability of the muscular fibres is stimulated, in some unknown manner, by the nerves, acting either under the direction of the will or independently of volition. The arteries and veins are kept distended by the currents of blood traversing through them perpetually in rapid motion. The viscera, the heart, and the organs for discharging the other necessary functions of animal life, the cellular membrane, which fills up the interstices between the different parts, the ligaments that bind them to each other and to the bones, the fat, and the outer covering of the skin, constitute the principal other substances that compose the form of man. The

contraction of the muscles when stimulated by the nerves gives motion to the limbs, the bones impart solidity to the form, and the circulation of the warm blood through the arteries diffuses heat and nourishment to every part.

If we confine our observations exclusively to these effects, without considering the causes that produce them, or by which they are sustained, the human body might be regarded only as a curiously complicated piece of machinery. When, however, we examine more closely into these effects, we perceive that numerous intricate causes must operate in their production, and we become aware of the existence of powers far surpassing those to be attributed to any machinery that it is possible for the utmost stretch of human ingenuity to construct, or the human faculties to conceive.

When, for instance, we inquire by what means the nerves excite the contraction of the muscles, or in what manner they contract; by what power the blood is forced through the arteries and veins, and by what means it is warmed and nourished; we find that the causes of those appearances which more immediately present themselves to observation, are much more deeply seated than we might in the first instance have imagined. We are able to trace the ramifications of the nerves to the brain, and the circulation of the blood to the pulsations of the heart, but there

our investigations terminate; — we cannot ascertain the cause that stimulates the heart, nor comprehend the power that actuates the brain.

In this view of the mechanism of the human frame we have confined our considerations to those appearances which present themselves on the momentary observation of its operation. The difficulties attending the explanation of the phenomena are prodigiously increased, when we consider that these effects are continued for many years; and still more so when we take into consideration the growth of the body, and observe that it is the residence of a power that exercises volition, and possesses sentient, reasoning, and intellectual faculties.

Let us, in the first place, limit our views to the numerous processes that must be completed to effect the mere sustentation of the corporeal machine.

The principal source of nourishment to the human body is derived from vegetable and animal products. The food, after mastication, is impelled by the muscles brought into exercise in deglutition to the stomach. There it undergoes important chemical changes by the action of the gastric juice, and is transferred in a semi-fluid state to the intestinal canal. This fluid, which is termed chyme, being afterwards mixed with pancreatic juice and bile, is forced through the numerous convolutions of the intestines by

the peristaltic motion of the bowels, and as it proceeds is absorbed by an immense number of minute vessels, which open into the intestinal canal, and carry off those portions of the aliment that are applicable to the nutriment of the body. Those nutritive parts, after undergoing various changes, are ultimately converted into blood, and are added to the contents of the veins. The blood, which is propelled by the muscular contractions of the heart into every part of the body, distributes its supply of nutriment through the minute vessels of the arteries to a variety of absorbing organs, by the agency of which it is assimilated to all parts of the human frame. Another source whence the blood derives a large portion of its nutritive properties, and whence it principally acquires its heat, is the atmospheric air. The venous blood, on its return to the heart, passes through the lungs, where it is exposed to the action of the air, and rapidly absorbs a large quantity of oxygen, and evolves at the same time a portion of carbonic acid gas. The condensation of the oxygen gas into a fluid in the blood occasions the evolution of a considerable portion of the heat which was before latent in the gas, and this heat being imparted to the blood constitutes one source, if not the principal one, of vital heat.

By the assimilating processes to which the food is subjected there are formed upwards of

thirty distinct kinds of fluids and solids, many of which possess such peculiar properties and are composed of such different elements, that it is extremely difficult to obtain an accurate analysis of their component parts. Among these various substances we may mention, as those with which we are best acquainted, muscular fibre, cellular membrane, bones, tendons, milk, brain, fat, skin, hair, nails, blood, urine, saliva, tears, sweat, and the gastric juice. These solids and fluids, and the numerous other juices that are secreted in various parts of the body, are all formed by the decomposition and organisation of the food taken into the stomach, and of the oxygen of the air inhaled by the lungs. Of the nature of the process by which the elementary particles of the food, combined with oxygen, are changed into these various substances, we can form no conception; and the process of their change into portions of the animal organisation, and of their adaptation so as to enable them to take part in the intricate phenomena of life, seem still more mysterious.

The difficulty which attends the comprehension of the process of assimilation in vegetables exists in full force, and with the addition of several other inexplicable circumstances, when we attempt to discover the nature of the process by which food is changed into a constituent part

of the living animal. The soil and the living plant were, in the preceding chapter, stated to be so dissimilar that no effort of abstract reasoning could induce the belief that the one originated from the other; but if that change would, without the aid of experience, be considered impossible, the apparent impossibility of such a transmutation is infinitely increased when the food of man is compared with man himself.

We have hitherto noticed only those processes necessary to sustain the animal frame in its existing state. The difficulties will be found to multiply when we consider the processes that must take place during the growth of a child from infancy to maturity. In the latter case all the former difficulties attending the comprehension of assimilation remain, and there is superadded the consideration, that every organ of the human body must not only be renewed, but must be also augmented by the addition of particles which, prior to the immediate time of their forming part of the system, possessed no feature of resemblance to the vital organ of which they are to constitute an active portion.

Of the causes of these extraordinary and mysterious effects our limited capacities will not allow us to form an idea. We must, however, admit that a cause does exist, and that it must have existed prior to the effects it produces. The organic products of that operating cause

may, indeed, afterwards become instrumental in promoting future assimilations of matter, similar to those they have previously undergone; but as those organic products were entirely the results of some previously existing cause, it would be contrary to sound reasoning to suppose that any organic arrangement of matter could create the cause by which it is organised. We are the more anxious to enforce this point, self-evident as it may seem, because several of the phenomena of physiology appear, on a superficial view, to countenance the belief that certain systems of organised matter possess the power of creating similar organisations, and that this power depends solely upon that peculiar arrangement of the elementary particles.

For the purpose of obtaining a more defined idea of the process of assimilation, let us consider what are the circumstances attending the growth of any given member of the animal frame. Let us take as an illustration the growth of the hand. Compare the hand of a child with that of a man, and observe the difference between the size, the flexibility of the joints, and the strength of each. The hand of the infant, however, in the course of time becomes gradually as large and as strong as the one with which it is compared. The source whence this increase in the magnitude of the bones, the muscles, the veins, the tendons, and nerves, is derived, is admitted

to be the blood, which is continually traversing along the arteries and veins, and even through the bones of the hand. As this fluid rushes along, the elements it contains that are adapted to the assimilation of those different members must be absorbed from it, and applied by them in their respective accretions of substance. The phosphate of lime, and other ingredients which enter into the composition of the bones must be secreted from the blood by the numerous glands immediately contiguous, and the bones must possess the power of applying and arranging the materials in their organised forms, so as to constitute a portion of the living skeleton of the hand, and to be capable of taking part in the animal economy. These newly formed portions of bone then become themselves possessed of the same power of assimilation; and the former inert particles seem to be thus endued with vital attributes, which dispose the accumulating osseous matter into its proper conformations, and enable it to discharge the requisite functions.

Powers of assimilation, in some degree similar to those we have noticed as existing in the bones, must also be brought into operation in the formation of the muscles, in the extension of the veins, in the enlargement and strengthening of the tendons, and in the ramifications of the nerves. Each portion of matter that is added to their composition becomes invested with vital

properties, that enable it to assist in the augmentation of the organic member of which it forms a part, and also to communicate similar properties to other portions of matter. The same process that occurs on the growth of the parts of the hand is also operating in the growth of every part of the body, and the miniature features, and limbs, and organs of the infant, are thus gradually enlarged, until they attain their full developement in manhood.

From the foregoing consideration of the mode by which animal organisation is perfected and sustained, it might appear that the action of organised matter alone is sufficient to create the vital functions; but this method of viewing the question would be very superficial; and it will appear on further consideration that we have as yet been occupied merely in examining the effects of organisation, and have not made any advance towards the developement of its causes. True it is, that the particles of living organised matter possess the power of moulding and adapting other particles to their own models; but what is the nature of that power, and whence is it derived? The power must exist before the effect can be produced, and none of the properties of the matter which constitutes the organic structure are capable of producing any effects similar to those observable in the formation of

the animal frame, and in the discharge of the animal functions.

As the power is not, therefore, the same as that of the ordinary properties of matter, it must either be distinct from those properties, or it must be some peculiar modification of them induced by the system of organisation. We discussed these questions relative to the separate nature of the powers that produce organisation in our preceding investigations respecting vegetable life, and we shall not now, therefore, travel again over the same ground, further than to call to mind the leading points of our position; viz., that if this assimilating principle be a distinct subtile property, it must reasonably be presumed to partake of the attributes of indestructibility and pre-existence in a degree not inferior to those properties which are subservient to its control; and that if the principle of organisation be caused by a modification of the ordinary properties of matter, then that modification of subtile indestructible properties must be equally indestructible with the original elements from which it was compounded or modified; and that, in either case, the power must exist before the effect can be produced.

CHAPTER XIX.

ANIMAL LIFE.

THE difficulties which attend the comprehension of the organisation of plants, and the nature of the vegetable principle, seem to dwindle into insignificance when compared with those which present themselves in the investigation of the formation and organisation of the great variety of substances that compose the human frame; and these, again, appear to be tangible objects in comparison with the consideration of the nature of the vital principle, which directs the numerous animal functions; and with the still higher and sublimer principles of vitality evinced in the exercise of the intellectual faculties.

The animal organisation and functions we have hitherto considered are produced by the simple involuntary effects of the living principle, whatever that principle may be. The bones, muscles, nerves, veins, and ligaments are formed without any consciousness on our parts of the process. Each organ of the body performs its functions without the exercise of our will. We observe that every part is furnished with an apparatus fitted for the renewal of the exhausted

and wasting membranes, and is supplied with proper materials for the beneficial working of the apparatus; but without the presence of a governing power, capable of making the complicated machinery available, and of setting the whole in motion, all the contrivances and evident adaptations of means to produce an end would be useless.

The existence of some cause which animates our frame, and which is the means of exciting the animal functions, and of developing the powers of sensation and volition, is universally admitted. The principal point of difference that arises on the subject is, whether these powers are pre-existent to, independent of, and separate from, animal organisation; or whether they are entirely dependent upon, and are created by, that organisation.

The vital principle in animals has usually been considered to partake of two or more distinct characters. Of these, the most marked distinctions subsist between that principle whose actions are not subject to the will — and therefore resemble in some degree the vegetative principle in plants — and the sentient and willing principles, which more especially distinguish animals from vegetables. Other distinctions, perhaps not less important, have been drawn between the mere sentient and willing principles, in which all animals participate, and the intellectual and

moral faculties, that are more peculiarly the attributes of man. The moral and intellectual powers of man do not, however, come within the scope of our present observations, and we shall therefore confine our consideration more particularly to the vegetative and sentient principles of animal creation.

The various functions peculiar to animal life were regarded, in the preceding chapter, as being discharged exclusively by the several organs of the body that are specially adapted for their performance; but though this is strictly the case, in an abstract point of view, yet when we consider these organs not as independent agents, but as only forming parts of the whole animal economy, we shall be obliged to search beyond the mere organs themselves for the cause that stimulates their action.

The immediate cause of the energy of the vital functions is the stimulus of the nervous system. The nerves, which are spread in minute ramifications through every organ, are traceable to the spinal marrow, and thence along the spinal chord to the brain; from which source, it is reasonably presumed, the stimulus of all the nerves is derived. The medullary chords of the nerves are united in different parts of the body into knots, or *ganglia,* and it has been supposed that these ganglia constitute secondary centres of nervous power,

that direct the involuntary functions of animal life. Whether, however, the moving power of the involuntary functions of the body proceed directly from the brain, or whether that power be delegated to the medullary chord of the spine and the ganglionic system, in whatever part it resides, some power there must be which excites, through the medium of the nerves, the irritability of the muscles attached to each organ. The heart continues to beat, the stomach to digest the food, the chyme to be absorbed by the blood, and all the secretions and assimilations of the body to be performed, without our consciousness of those processes, which proceed uninterruptedly whether we are awake or asleep; and unless we suppose that these extraordinary effects can be produced without any cause, we must conclude that some power is always operating to stimulate the organs of vitality in the discharge of their functions. Where does this power reside? how does it operate? in what does it consist?

The first question may, perhaps, be rationally answered by referring to the brain as the ultimate corporeal residence of this power; but the other questions involve the elucidation of the nature and operation of the vital principle, which is a subject far too subtile for investigation by the human intellect, and respecting which we must be content to remain in ignorance.

Though we cannot, consequently, make any advance towards a knowledge of that inscrutable essence, it will be of considerable importance to establish its existence as a separate principle; and though we cannot ascertain the laws by which it is governed, we may arrive at a knowledge of some of its attributes.

In our consideration of the processes attending the continued operation of the functions of animal organisation, we regarded every portion of the human frame as endued with power to assimilate the juices that supply it with nourishment into its own constituent parts. The bones, the muscles, the integuments, &c. were each represented as being able to convert the secreted fluids into other portions of bone, of muscle, &c., which newly created portions in their turns become capable of taking part in the great work of assimilation.

As these effects are entirely dissimilar from those of any of the known properties of matter, they were ascribed to the agency of some distinct organising principle; and that principle, it was argued, must exist prior to, and be independent of, the matter it organised. But this assimilating power of the organs of the human frame — in whatever light we regard it — requires the presence of some other power to bring it into action, and cannot be developed excepting by that stimulus. The nerves, we have observed,

are the agents by which that stimulus is imparted; but when we examine the texture and composition of the nerves, we are unable to discover in their structure and constituent parts, any cause calculated to set the animal machine in motion. We find, also, that the nerves themselves are enlarged with the growth of the body. They must therefore possess the power of assimilation, and that power must be made to operate by the agency of some more remote cause, which stimulates the nerves to the work of augmenting their own substance. We may trace the nerves through their innumerable ramifications to the spinal chord, and to the brain; but in neither of those substances can we perceive the slightest indication of a cause adequate to excite the power of assimilation, or to the production of any effects in the least resembling it. The brain, too, increases in size with the growth of a child to manhood, and we must, therefore, search for a cause independent of the brain that is competent to produce the effects of its organisation.

In endeavouring to trace the effects of organisation to their causes we thus arrive at last — after ascending all the perceptible links of the chain of connection — at the brain, the seat of sensation; and we discover that there is yet a cause beyond, past finding out, which stimulates and governs the whole system of organised animal matter. The system of animal organisation

without the vital principle, may be compared to the complicated machinery of the steam-engine before the application of its moving power. The boiler, the pipes, the piston and valves, the connecting rods and wheels of the latter, which are so ingeniously contrived and so well adapted for the continued working of the machine, are entirely useless when the heat which serves to set the whole machinery in motion is withdrawn. The power of heat to communicate expansive force to steam is, however, the same, whether that power be manifested by the confinement of the steam in the boiler of the engine, and its application as the moving principle of the machinery, or whether the steam be allowed to escape and to dissipate itself in air. The machinery is made and adapted for the application of the moving power; and that power is not produced by those complicated combinations of machinery, but exists independently of those arrangements of material forms by which the properties of the expansive force of steam are manifested.

We may extend this analogy of the connection between animal organisation and the living principle with that subsisting between the machinery of the steam-engine and its moving power, and deduce from it an apt illustration of our progress in discovering the source of animal life by comparing our progressive efforts with

the steps by which a person unacquainted with the steam-engine would arrive at the source of the power which imparts motion to its complicated machinery. He would trace the motion of the fly-wheel to the rod that works the crank; the motion of the rod to that of the working beam, the latter to the perpendicular motion of the piston rod; the piston rod he would be able to ascertain was impelled upwards and downwards by the expansive force of the confined steam; and that expansive force he would discover was imparted by the heat derived from the combustion of the coals. So far he would be able to trace effects to their causes in an uninterrupted and intelligible series; but having arrived at the ultimate apparent cause of the motion, he would then find that he was unable to comprehend the nature of heat, which produced that effect, or of the mode by which it communicated an expansive power to steam. Should our inquirer, in consequence of his inability to comprehend the nature of heat, or its modes of operation on aqueous vapour, be disposed to doubt the existence of such a property distinct from the machinery with which he sees it connected; and were he, still further, to infer that the steam which sets that machinery in motion is produced by the operation of that peculiar mechanical arrangement, such an inference would immediately be considered as most puerile

and unphilosophical. Yet surely such a conclusion would be as reasonable as that which supposes the motive power of a system of organisation to be merely the result of that organised system; for not only does such a supposition in the latter case involve the absurdity of assuming a cause to be produced by an effect, but it further assumes that this cause-creating effect is also self-created.

Though physiologists differ in their opinions respecting the seat of the involuntary powers of the animal functions, no doubt is entertained respecting the locality of the sentient and voluntary powers. These are, by all physiologists, we believe, allowed to be situated in the brain, which, it is concluded, communicates through the nerves the mandates of the mind to the obedient muscles.

The brain, which is thus acknowledged to be the residence of this power of directing the motions of the body, has long been an interesting object of investigation to the anatomist, the physiologist, and the chemist. Without attending to the minute subdivisions that have been introduced by the phrenologists, we may state, generally, that the brain is divided into three distinct portions, which have been termed by anatomists the *cerebrum*, the *cerebellum*, and the *medulla oblongata*. The latter portion of the brain occupies the lower and posterior part of

the cranium, and is the immediate source of the spinal marrow, which it closely resembles in appearance. From this portion of the brain also proceed the nerves that convey the impressions from the external senses.

Of the functions of these three distinct portions of the brain nothing is positively known, though it has been conjectured, with great appearance of probability, that the cerebrum, (which occupies the anterior portion of the cranium) is the seat of the intellectual and moral faculties; that the cerebellum is the residence of the animal passions and propensities; and that the medulla oblongata is the seat of external sensation, and the source of the involuntary actions of the muscles. The phrenologists, indeed, imagine that the brain is divided into numerous compartments, to each one of which is allotted the discharge of separate functions; and they conceive they have discovered in the different convolutions of its medullary substance the residences of distinct intellectual and moral faculties. The science of phrenology is, however, at present such questionable ground, that we shall not venture to explore it, nor to found any arguments upon the principles which it professes to establish; but there seems to be little doubt entertained, even by those who dispute the doctrines of phrenology, that the three great divi-

sions of the brain to which we have alluded are employed in the discharge of different functions.

If we are obliged to refer sensation and volition to the agency of the brain, as the last link in the chain of connection between the effects of organisation and their causes which our obtuse faculties will enable us to discover, what is there, it may naturally be inquired, in the texture and composition of the brain that can lead us to suppose it to be the original source of these powers? The brain is composed of a medullary mass, parts of which are disposed in various convolutions. Its chemical composition is extremely complicated, but it does not evince any peculiar chemical affinities; and whether we consider this substance as acting *en masse*, or in separate compartments, we cannot conceive any possible means by which it can either feel or act. When, in addition to the powers of sensation and volition, we consider the brain as the organ of the intellectual faculties of thought, memory, reason, judgment, &c., we cannot fail to be struck with the apparent inadequacy of the means by which those faculties are called into operation; and so far from being induced by an examination of the substance of the brain to suppose that it feels and acts, and thinks and reasons, we are inclined to doubt the possibility of such a mass of apparently inorganised matter becoming even a subordinate agent for the transmission of feeling

and volition, and for the exercise of thought and judgment.

Shall we, then, conclude that we have arrived at the first cause of the vital principle when we have only succeeded in tracing it to a material substance that presents no indication of vitality, and that bears not the most distant analogy to our conception of the intellectual faculties? — or shall we presume that there is yet an undiscovered cause that acts upon the brain too subtile for detection by the mental powers of man?

We cannot, indeed, understand, even if we take a strictly material view of the nature of the vital principle, how, in accordance with the ordinary mode of considering matter and its properties, it can be regarded otherwise than as distinct from the mere material composition of the brain.

It appears, from chemical analysis, that in every 100 parts of brain there are about eighty parts of water, about five parts of fatty matter, seven of albumen, one of a peculiar animal principle, derived from muscular fibre, called *osmozome*, one and a half of phosphorus, and the remaining portions consist of different salts and acids. When these component parts of the brain are reduced to their known elements, very nearly the whole mass is found to be composed of hydrogen, oxygen, carbon, and nitrogen in different combinations. These substances, whether

in their compound or elementary forms, possess no properties, when considered separately, at all analogous to those qualities that are developed by the exercise of volition, and of the mental faculties; nor can we conceive in what manner it is possible for any combination, or modification, of the properties they possess to produce such extraordinary effects. But admitting, for the sake of argument, that it is possible for a certain combination of different bodies to generate active qualities capable of controlling and directing the whole functions of the human frame, yet this modification of the properties of matter we must presume to be distinct from mere matter itself. For — unless the views we have taken of the nature of the properties of matter be entirely erroneous — the qualities with which the particles of different substances are endued are distinct from, and to a certain degree independent of, the mere inert matter with which they are connected; and if that position holds good with respect to the simple properties of matter, it must also be true with regard to their combinations. If, therefore, we were to conceive it possible for any combination of inanimate matter to create a sentient, willing, and intellectual principle, that newly-created power must be altogether distinct from the inert compound mass by which it is developed. In this view of the question, therefore, we should be obliged to refer

the vital principle to the operation of some invisible, unknown, subtile power acting upon and controlling the matter by which it is supposed to be generated. The difficulties attending the consideration of the operation of the vital functions are not in the least degree diminished by this hypothesis; and, in addition to those difficulties which surround the subject, on the supposition of the phenomena of life being caused by the existence of an immaterial living principle developed by material organisation, there would be superadded the incomprehensible and perpetual self-creation of sensation, volition, and intelligence out of inanimate matter.

It may, perhaps, be considered unnecessary further to pursue the line of argument against the notion of the percipient soul being created by a combination of different forms of matter; but there is one other point of view in which it may be regarded, that ought not to be omitted in this consideration of the subject.

In reasoning upon this hypothetical material living principle, we must, it is to be presumed, conclude, that the mode in which the principle is generated is similar to that in which subtile active principles are called into operation by other combinations of matter with which we are acquainted. Let us examine, then, into the circumstances attending the developement of known active principles by such combinations. Let us,

for instance, take galvanism, as being most analogous to the vital principle, and consider the means by which it is excited, and the nature of its connection with the substances exciting it. In considering this property of matter, in a former chapter, it was stated that the mere contact of two metals possessing different degrees of attraction for oxygen is sufficient to excite galvanic and electrical phenomena, and that the addition of any substance facilitating the oxidizement of one of the metals increases the activity of the developement. The same effect may be produced by the agency of numerous other bodies that act chemically on each other, without the employment of metals; and even by the mere friction of substances between which no chemical attraction whatever subsists. Now, surely, no one can imagine that the galvanism excited by the contact of a piece of zinc and a piece of silver is a positive *creation* of an active power which becomes materialised in the metals; or that the galvanism excited by other and more complex combinations forms a material part of those combinations; still less is the idea of the materiality of this peculiar quality reconcileable with the developement of electricity by friction, in which case no perceptible chemical action takes place. Electricity and galvanism also are developed by the combination of such

numerous substances and by such a variety of modes of action that it is impossible to consider the same property — viewing it as a material compound — capable of being composed of such various ingredients, and of being produced in such varieties of ways. The opinion that seems most in accordance with the phenomena of galvanism and electricity, and the one that is generally adopted by philosophers, is, that that property is a previously existing subtile agent, and that it is therefore not created, but is merely rendered perceptible, in some unknown manner, by chemical action and by friction.

Now if the supposed materialised vital principle be presumed to be called into operation in a similar mode to galvanism and the other properties of matter, the arguments of the materialists, when pushed to their legitimate consequences, would militate directly against their own opinions, and would thus tend to establish that part of our position which rests upon the existence of the living principle distinct from the mere matter that constitutes animal organisation. Unless they are prepared to affirm that the sentient and intellectual principles are more material, more tangible, and more comprehensible than galvanism and the other subtile properties of matter — or unless they can point out some mode by which these etherial agents are generated, dif-

ferent from that by which other active subtile principles are developed — they must admit, that the peculiar organisation of the brain, instead of creating, only calls into operation, their supposed material living principle. That principle must, therefore — even if viewed as a material substance — exist prior to, and independently of, the animal organisation by which it is thus supposed to be developed; and if it existed previously to its connection with animal organisation, we must reasonably conclude it will continue to exist after that connection is dissolved; unless we were to suppose it possible for the subordinate agent, which merely calls the principle into perceptible operation, to possess the property of annihilating the power by which itself is governed.

Though the vital principle is unknown to us in any state distinct from animal organisation, yet, in every point of view in which we can bring our mental powers to bear upon the subject, the sentient and thinking principles seem so entirely different from any known material substances, that we cannot form any conception of mind or sensation than as distinct from every possible combination of matter; and the preceding consideration of this subject has, it is hoped, been sufficient to show that the hypothesis of the materialists, which supposes the percipient soul to be the result of animal organisation, does not

remove any of the difficulties supposed to attend the belief in the immateriality of the vital principle, whilst it is obliged to have recourse to the transposition of cause and effect; and it further involves the absurdity of supposing that all beings are self-created.

CHAPTER XX.

ORGANS OF SENSATION.

THE communication between man and the external world is carried on entirely by the instrumentality of the five senses of touch, taste, smell, sight, and hearing; and not only are all our ideas derived from those sources, but we cannot conceive of any mode by which knowledge could be otherwise obtained. It consequently becomes an object of considerable interest to trace, as far as possible, the means by which those impressions that constitute the foundation of our ideas, are conveyed to the mind.

The sensations of feeling and taste are only called into operation by actual contact with the substances exciting them. Minute papillæ from the nerves are spread under every part of the external cuticle of the body, and the impressions of any substance on the skin are consequently conveyed directly from those papillæ to the nerves, and thence to the brain. A series of separate papillæ arising from other nerves, that lead directly from the medulla oblongata to the tongue, are spread over the upper surface of that organ; and the impressions which are made

upon it may, consequently, be regarded as being caused by an immediate action upon the nerves themselves. In neither case, however, can we understand by what means any impression whatever is produced in the mind by the contact of the papillæ of the tongue or of the skin with the substances that excite the sensations of taste or feeling; and still less can we comprehend by what means the same substance can excite a different sensation, when brought into contact with the skin, and when it is applied to the tongue.

The senses of taste and feeling, though extremely different in their impressions, have a similarity of character, inasmuch as the sense of taste seems to be only a modification of simple sensation. The other senses are, however, very different from either touch or taste, and they are also separately very dissimilar. Their effects are produced by subtile agents emanating from the exciting bodies; which agents — so far at least as regards sight and hearing — are distinct from the bodies themselves, and the impressions produced by them have no appreciable connection with their immediate causes.

In the sense of smell, however, it is frequently difficult to make a distinction between the object itself and the emanation from it that excites the sensation. In the case of noxious gases, for instance, smell seems to be excited by actual contact with the offensive substances; but as we

cannot conceive this mode of perception to bear any relation to the impress of tangible objects, it has, consequently, no resemblance to, nor can it be associated with, the sensations excited by touch and taste. The organs of smell, however, resemble in their operation those of the two latter senses; for, as the impressions are conveyed immediately by contact with the substance itself, or with some material aëriform emanation from it, there is no necessity for any intermediate apparatus to communicate those impressions to the nerves. This communication is effected, as in the senses of touch and taste, by the expansion of the filaments of the nerves that proceed from the medulla oblongata on the surface destined to receive the impression. The papillæ branching from the olfactory nerve are spread over the whole interior of the nostrils, and the actions of odoriferous and noxious effluvia on these papillæ are transmitted by their immediate communication with that nerve to the brain, and causes, in some inscrutable manner, the sensation of smell.

The sense of hearing is produced by agents less immediately connected with the original cause of sound; and the simple expansion of the nerves into papillæ, which arrangement is sufficient for the excitement of the three senses already noticed, would not suffice for the developement of the sense of hearing. In the latter

case the sensation is produced by the communication of a vibratory motion to the medium of sound. That medium is altogether distinct from the object which acts upon it, and the motion by which the sound is conveyed is distinct from both.

We may, perhaps, conceive that the faculty of hearing might have been developed in a similar manner to that in which the senses we have already noticed are brought into operation—by delicate expansions of the nerves into papillæ; but the vibrations communicated to the air in moderate sounds are so feeble and imperceptible, that any system of nervous papillæ sufficiently sensitive to receive their impressions directly from the impulse of the air, would almost inevitably be exposed to external injury. To remedy the inconvenience that would attend such a disposition of the organ, the ear is constructed for the purpose of collecting and concentrating the vibrations; which are then received upon the tympanum, and thence communicated to the liquid within the cavern of the ear, which serves as the final medium of communication between the external organ and the nerves which convey the impressions to the brain. By what means, however, these vibratory motions, which may be thus traced to the brain, excite the sensation of sound, we cannot discover nor conceive. The idea we entertain of sound bears no more resem-

blance to that of motion than the idea of the colour of an orange bears to that of its taste; and in this, as in all other attempts to discover ultimate causes, we perceive the insufficiency of our mental powers to penetrate the mysteries of nature.

The organs of sight are the most complicated, and appear to evince more elaborate and skilful adaptation of means to an end than any of the senses. We have already noticed the properties of light, and the transmission of its rays, at an inconceivably rapid rate, from all luminous bodies, in every direction, to the utmost bounds of space. Those rays, it was mentioned, possess the property of refrangibility, in consequence of which they are converged, after passing through a convex lens, into points in its focus, and there form an image of the luminous objects presented before it. The eye is composed of various lenses, of different degrees of density, and its beautiful mechanism is entirely directed to the formation, by those lenses, of clear and distinct images of visible objects on the retina, which is placed at the back of the organ for the reception of the concentrated rays of light.

It is not within our province to enter into a minute description of the separate parts of the eye, nor to comment on the admirable adaptation which its mechanism presents to the purposes they were intended to serve: it will be suf-

ficient merely to point out, generally, the means by which the appearances of external objects are conveyed by this organ to the brain.

The importance of vision in the animal economy is manifested by the abundant supply of distinct pairs of nerves for the discharge of the functions of the organ. The most important of these is the optic nerve, which issues from the medulla oblongata, and is carried towards the back of the eye, where it is spread out in a most beautifully fine netlike form, and composes the retina, or screen, on which the images of external objects are received. Behind this screen of delicate nervous fibres the choroid or innermost coat of the eye is spread, which is covered with a black pigment that completely prevents the rays of light from passing beyond the retina, on which they are brought to a focus. The image is then conveyed by the optic nerve directly to the brain, where it excites a sensation of form and colour, which we believe to correspond with the forms and colours of the objects from which the rays of light issue to the eye.

The organs of sense are not of themselves sentient, but are merely the media for conveying their respective sensations to the brain. We are so accustomed, however, to consider sensation as resident in the organ which excites it, that an exertion of the powers of reflection and reason is necessary to convince ourselves of

the contrary. With respect to the senses of touch, and taste, and smell, it is, indeed, very difficult to conceive that they reside elsewhere than in the organs themselves; but from the consideration of the structure of the nerves alone, which are all to be traced to the brain, it might be inferred that the minute expansion of the nervous filaments in those organs of sensation are only subservient agents of the brain, whence they emanate. If, however, any doubt were to exist on this subject, it would be entirely removed by the results of anatomical experiments on the nerves of living animals, which have established the fact, that when the nerves which communicate from the brain to any organ of sense are divided, the sensation of that organ ceases, though the impressions that usually excite it may be continued.

With respect to the senses of hearing and sight, but more particularly the latter, the organs serve so manifestly merely as means of communication between external objects and the nervous system, that no one who examines the structure of the eye and of the ear can doubt for a moment that they are only the intermediate agents of vision and of hearing. When an image is impressed on the retina, it is true, the communication is completed, and the nerves are directly acted on; but no one at the present day, who has paid any attention to the subject, imagines

that the retina is sentient of the images impressed on it. The impression is communicated by that delicate membrane to the optic nerve; and from that nerve it is conveyed to the brain. But is the brain itself sentient of the impressions it receives from the optic nerve? or must we refer to some other source for the percipient power?

We have seen, in our preceding notices of the functions of animal life, that the organisation of the substance of the brain must be produced by some principle distinct from its material composition; and as we find it necessary to refer the augmentation and arrangement of its material particles to a governing subtile agent, we shall be equally obliged to refer the perception of the forms and colours of distant objects — our ideas of which have no conceivable connection with substance — to the agency of some presiding subtile or immaterial principle, to which the impressions imparted to the brain are transferred.

It is a disputed question in metaphysics, whether the perception of external objects is excited directly by their impressions on the brain through the nerves, or whether it is produced by an act of the mind; which, it is supposed, infers the existence of external objects from the sensations excited by those impressions. Des Cartes, Locke, Hartley, Hume, and many other philosophers, contend that the mind does not receive the impressions of the senses im-

mediately from the brain, but that each sensation is the result of a process of reasoning and of association; which, by constant exercise, has become almost simultaneous with the impressions, so as to leave no perceptible interval between them and the ideas which this process of reasoning conveys to the mind. Dr. Reid, and some other metaphysicians, on the contrary, maintain that the ideas received from the senses are the direct results of the impressions of external objects on the brain, conveyed to the mind without any intermediate reasoning process. This question is, however, of a purely metaphysical nature, and it is only adverted to for the purpose of showing, that the opinions of the majority of those who have devoted their attention to the study of mental operations, are so far from countenancing the belief that the material organisation of the brain produces the intellectual faculties, that they conceive not a single idea can be formed, even from the impressions of external objects on the organs of sensation, without an intermediate mental process, which resolves those impressions into the idea which we conceive of the objects exciting them.

By whatever process we may conceive the ideas of objects to be excited in the mind, it must be admitted that the immediate agent in producing them is the brain; and that the organs of sensation are merely connecting links in the

chain of communication between the objects and the sensorium. In the sense of sight these links in the chain of communication are more distinctly perceptible than in the other senses, and the organs of that sensation will therefore afford a good exemplification of the successive processes by which the impressions of objects are stamped on the mind.

In the first place, the presence of light is absolutely necessary to bring the organs of vision into action. It has been previously stated that the nature of light and its modes of operation are beyond our comprehension; that its rays, though the cause of vision, are of themselves invisible; and that the transmission of light is a process opposed to all our ideas of the ordinary communication of motion. In the very first stage of our inquiry into the nature of vision, therefore, we have to deal with a subtile agent that is completely removed beyond the cognisance of our faculties. We know, however, that by some inscrutable means the rays of light are transmitted from luminous objects to the eye. They are then converged by the lenses of that organ into separate points on the retina, and there form an image of the objects from which the rays of light proceed. Of the mode by which the rays are refracted in this second stage of the inquiry we are quite as ignorant as we are of the nature of light, though we are able to ascertain

the laws that regulate its refrangibility. The image when formed on the retina occupies a space about equal to that of a sixpence, though the numerous objects there depicted may be miles asunder, and of stupendous magnitude. Nevertheless, though the image be so disproportionate to the objects, the ideas conveyed to the mind have no relation to the diminutive size of the images from which the impressions are directly received, but correspond with the real sizes of the objects, with which the mind has no immediate contact.

The images on the retina are inverted, and it has, singularly enough, been imagined from this circumstance, even by those who have paid attention to the science of optics, that all objects are seen in an inverted position; and it has been supposed that the error is rectified by the sense of touch, until at length, by frequent experience, we learn to conceive the objects to be placed in different positions from those in which they are presented to the mind. This supposition must have arisen from the now exploded opinion that the retina is the seat of sensation; and it appears to be so rude a conception, and to be founded merely on superficial observation, that it is surprising that men distinguished for scientific research should have acceded for a moment to a notion so thoroughly unphilosophical.

After having traced the impressions of external objects to the retina, the remainder of the process of communication with the brain is totally incomprehensible, and is utterly irreconcileable with the laws that regulate the transmission of light. We find that the impressions on the retina are next transferred to the optic nerve. But how are they transferred? The optic nerve is not transparent, and therefore it cannot admit the passage of the rays of light. It is curvilinear in its course to the medulla oblongata; and as light moves only in straight lines, the optic nerve cannot therefore convey rays of light from the retina to the brain. There are no apparent means provided in that medium of communication for transferring the images of objects, such as we behold them, from the retina; and it is found, from experiment, that the optic nerve is insensible to the impression of light when the rays fall directly upon it. The communication between the retina and the brain must consequently be made by actual impressions totally distinct from those ideas of the nature of light which are excited by the perception of luminous rays.

The sensations produced by touching a hard substance, and those which we receive on looking at the same object, are as dissimilar as it is possible for us to conceive any sensations to be; and yet we are induced to believe that the sens-

ation of sight, when minutely examined, resolves itself into an extreme sensibility of the organ to impressions from external objects, communicated through the medium of light. Nothing resembling our ideas of luminous rays can be transmitted through the opaque substance of the optic nerve, and the impressions must, in accordance with our conceptions of all possible modes of communication, be made either by motion of the substance of the nerves, or by some rapid chemical action.

Our investigations respecting the seat of the perception of sight, terminate, like those relative to the percipient power of the other senses, in the brain. The impressions made upon that substance by the optic nerve cannot, if the foregoing inference be correct, bear any relation to our ideas of light; and whether we assume these impressions to be of the nature of vibratory motions, or of chemical changes, in either case it is impossible for us to conceive how any kind of motion, or any species of chemical action, can produce an *image* of external objects in the brain. The actual impressions made on the sensorium cannot, we must therefore conclude, bear any resemblance to the image formed on the retina; and the idea of external objects — corresponding with that image in form and colour, though differing from it in magnitude — must be derived through some other medium, as dis-

tinct from the nature of light as light is distinct from the objects by which it is reflected to the eye.

Though we are thus enabled to ascertain that the means by which the sense of sight is excited bear no conceivable relation to the sensation itself, our attempts to investigate the mode of its operation are completely baffled, and we are compelled to admit it to be a subject beyond our comprehension. But even supposing we were able to discover by what means the impressions of light on the retina are conveyed to and operate on the brain — whether it be by vibratory motion or by chemical action — we should be no farther advanced in our knowledge of the mode by which either of those processes could excite the idea of form and colour. Again; supposing our faculties were enlarged, so as to enable us to perceive a direct connection between the action of those impressions on the brain and the visible objects that produce them, we should have still to discover the percipient principle which finally receives those impressions, and which forms the idea of external objects in the mind.

Where are we to look for this principle? Can it be supposed to constitute a portion of the material mass of the brain? Surely not; for it passes the bounds of all conceivable possibilities that the action of one species of inanimate

matter upon another should create a principle capable of perceiving the effects of their united action. But even if we were to suppose that the sentient principle originates from a peculiar unknown modification of the properties of matter, produced by the organisation of the brain, it has been previously shown that such a disposition of the properties of matter must exist distinct from mere inert material substance; and we should, even on that supposition, be obliged to refer perception to some principle distinct from the mere medullary mass of the brain. We have seen, also, when considering the functions of organised life, that the augmentation of the brain, and the motive cause of the animal functions, must be attributed to the operation of some subtile agent distinct from the matter that is organised; and if those positions be founded in truth, we cannot surely hesitate to refer the percipient principle to the existence of some power beyond the mere arrangement of the material particles of the brain.

It cannot reasonably be urged as an objection to this view of the question, that there is no indication in the structure of the brain of its being a subservient medium of communication with any other power. It is true, that we cannot trace the chain of secondary causes and effects beyond the brain; but, as our faculties are avowedly incompetent to detect even the com-

monest subtile properties of matter, and as the percipient principle is presumed to be much more etherial than any material agent, the want of power to perceive the presence of such an immaterial essence cannot be advanced as an argument against its existence. If such an argument were admitted to be valid against the existence of a subtile percipient principle, it would be equally applicable against the existence and operation of every property of matter, and of every chemical and mechanical action; for those properties and modes of operation are, equally with the vital and sentient principles, beyond the bounds of our comprehension. Nay, if we were to deny the existence of a subtile percipient principle merely on the ground that the brain presents no indication that its operations have reference to other powers than itself, and were we to maintain that perception is, therefore, the sole act of that organ to which the perceptible impressions can be traced, we should be forced to the conclusion that the retina of the eye possesses the power of perception; for we are unable to trace the progress of light beyond that membrane. Were we to assume, in short, that when we have reached the limits of our faculties in tracing effects to their causes, we must have consequently arrived at the ultimate actuating principle; and were we to infer that the last organ to which we can trace operating causes

must contain the final cause of all, we should reason as wisely as the savage who, when looking through a telescope at a distant object, supposes that it is contained within the tube, and who, acting on this impression, breaks the instrument to seize the expected prize.

The extent and degree of the mutual dependence of the different links in the chain of communication between objects of sensation and the percipient power, afford a subject for consideration well deserving notice. The agents that are subservient to the developement of each sense would, if separate, be perfectly useless for the discharge of their appointed functions; and if one link in the chain were broken, the remainder would be rendered entirely unavailable. But though each agent in the ascending scale depends upon the operation of the subordinate agents for the exercise of its power, yet every separate agent has an independent existence.

A reference to the phenomena of vision will serve to illustrate these mutual dependencies of the agents in producing a combined effect, and their independence of each other when viewed abstractedly. The property which visible objects possess of reflecting the rays of light, would be useless towards rendering their forms and colours apparent to the eye if there were no light to bring those powers into operation. The extraordinary properties of light and its power of re-

fraction would be of no avail without the instrumentality of the lenses of the eye; the wonderful mechanism of the latter would be designed in vain if the retina were not spread as a screen to receive the concentrated rays; the formation of the image on the retina would not, however, excite any impression, unless the optic nerve were to convey the impression to the brain, and the sensation of sight could not be experienced without the presence of some percipient power to receive the impressions which those numerous agents mutually contribute to produce.

Though all the links in the chain of communication between external objects and the power of perception are, therefore, intimately dependent on one another for the production of their combined effect, yet each agent is distinct, and enjoys the capacity of exerting its individual properties in the absence of co-operating agents. Thus, the outward forms of objects exist, and they possess the peculiar property that enables them to decompose the rays of light, whether light be present or not; the properties of light, again, have no necessary reference to the structure of the eye; nor does the image on the retina bear any discoverable relation to the construction of the optic nerve; the latter is not essential to the existence of the brain, which is the more immediate agent of communication with the percipient power; and the power of perception is

not extinguished nor diminished when the operation of all those agents that serve to bring it into action are suspended. Nay, we know that every subservient agent — with the exception of the brain — might be destroyed without injury to the percipient principle; and when the impressions derived from external objects have been conveyed to the mind by the medium of the organs of sense, the ideas excited by those impressions are retained long after the objects that excited them have ceased to exist.

Our incapacity to investigate the nature of the connection between the percipient power and the brain, prevents us from ascertaining positively whether that power is independent of the brain, as well as of the subordinate organs of sensation. But the foregoing consideration respecting the abstract independence of the several constituents of the organs of sensation, and the independence of the power of perception, present strong analogous evidence that the percipient principle is not dependent on the substance of the brain for its existence as an active power, though its peculiar and inscrutable properties are brought into action by material substance. And when, in addition to this analogical evidence, we find that the substance of the brain bears no conceivable relation to the ideas excited by the organs of sense, and that we are obliged to refer the organisation of the brain itself to some subtile

governing power, we feel irresistibly led to the conclusion that perception is not the mere result of material organisation; and that this mysterious power must be referred to some subtile immaterial principle, that is only connected with the brain as the last perceptible link in the chain of communication with material objects.

CHAPTER XXI.

ANIMAL MUTATIONS.

THE gradual changes that are constantly taking place in the animal frame, which produce a complete alteration in all its constituent parts, whilst the outward form and mental consciousness remain the same, afford striking evidence in support of the opinion that mind is not essentially dependent upon matter; and the more remarkable, because more rapid, mutations that occur in several portions of the animal creation, by which the forms and habits of living beings are entirely altered, present a beautiful material emblem of that change wherein "mortals shall put on immortality."

The exhaustion which the several members of the human body undergo in the discharge of the functions of life, renders it necessary that they should be continually supplied with fresh nutriment. The material composition of every organ must, consequently, be ever varying, and in a few years not one particle of the same matter that composed the form of an individual remains. The brain, as an integral portion of the animal organisation, must participate in these changes

and renovations; and if we suppose perception to be merely the result of some process carried on by the material substance of the brain, not referable to any superior agent, we must conclude, that when the particular system of organised particles which receive an impression is destroyed, the impression made on those particles of matter must also be dissipated.

So long as the same matter remains, we may conceive that an impression once made on it might endure; but when no part whatever of the former substance exists in combination with the same system of organisation, it is impossible —on the supposition that the organised substance produces sensations merely by its own action — to imagine that the effects of any impressions can remain after the substance impressed is destroyed.

If perception, therefore, be the simple act of organised matter, we cannot suppose that the ideas received by the organs of sense from any object, can continue when the organised matter that constituted the idea is removed. Perception, under such circumstances, could only be transient in its operations, and could leave no lasting impressions; for the substance which is supposed to be actually the percipient being is, in a short time, supplanted by other materials, with which it can have had no previous connection.

Experience, however, informs us that percep-

tion is not of this evanescent character. A man who is totally deprived of sight does not lose the idea of distant forms, nor the idea of colours, though numbers of years may have elapsed since the impressions of either were made on his brain, and every material particle of that substance must, in the mean time, have been changed. If he have once had the proper use of this sense, he never afterwards so far loses the impressions of light and colour as not to be aware that there are other means of ascertaining the existence of objects beyond those of taste, smell, touch, and hearing. But, on the supposition that it is the mere matter of the brain which, in consequence of some peculiar undiscovered organisation, is enabled to perceive the forms and colours of distant objects; when that organised matter which perceived these external qualities is removed, and its place is supplied by other matter that never received any impressions whatever from the optic nerve, we ought to conclude that such a brain would not have any more conception of the effects of light, than the brain of a man who never enjoyed the sense of sight.

A still more forcible illustration than the foregoing of the retention of ideas received through the organs of sense after the material organisation is changed, is furnished by simple sensation.

When the limbs are pressed by any substance,

or receive any injury, the impression is immediately conveyed by the nerves of the limb through their various ramifications to the brain, and the percipient power instantly becomes aware of the injury or pressure. This feeling is produced by a direct action on the nerves, and this sympathy of sensation might be supposed to continue between the limbs and the brain so long only as the direct connection between them was maintained. If, indeed, the perception of pain were the act of material organisation, we should conclude, that when the substance is removed on which the painful impression was excited, all sensation produced by such impression would be destroyed. It is known, however, that persons who have suffered the amputation of a limb frequently experience a sensation as if proceeding from the amputated member; and this sensation continues for years after every atom of the original substance, both of the connecting nerves and of the brain, that ever had communication with the living limb, has been changed.

It must be evident that under such circumstances the sensations alluded to can be produced only by associations in the mind of certain existing nervous impressions with those sensations that were formerly excited by the nerves of the lost limb. These associations, it must be remembered, exist long after the destruction of

the identical material organisation that first excited them, and we shall therefore be obliged to admit that the impressions communicated to those previously existing particles of organised matter must have been distinct from the matter itself, or they could not continue in activity after every vestige of the material substance that excited them has been dissipated.

Now, if from the consideration of the lasting impressions derived from the organs of sensation we are led to the conclusion that the percipient power must be distinct from mere material organisation, the intellectual faculties — those of thought and memory more especially — will force the same conclusion upon us with redoubled energy. Not only are particular impressions and perceptions recalled to mind by the memory, but certain trains of thought, events, arguments, and feelings, that have perhaps slumbered in the mind for a series of years, may be brought to recollection, and appear nearly as vivid as at the time they were first impressed on the brain. The treasures of the memory, it must be remembered, are thus preserved in the recesses of the mind long after every particle of the human frame with which the events and circumstances were first connected has been changed.

If the substance of the brain be, as the materialists imagine, the ultimate agent of

thought and memory, the impressions made upon it by the external senses, and the ideas resulting from those impressions, must be excited by some chemical or mechanical action in the medullary matter itself; and if the whole of that substance on which the supposed action operates be changed, we ought, as a natural consequence, to expect that the peculiar modifications it received from such action would also disappear. Should it, however, be asserted that the organised matter, after having received impressions which produce certain modifications in its composition, has the power of transmitting those modifications to other organised accretions to its substance, whilst the matter itself is decomposed, what is such an assertion but an admission that the substance of the brain consists of distinct qualities, and is separable into two different principles?—one of which is liable to all the vicissitudes and decompositions of matter, and the other of a more subtile and imperishable nature, which continues to exert its energies after the organised matter with which it was originally connected has been resolved into its simple elements.

We cannot conceive in what other manner the materialists can account for the retention of ideas after the matter that formed them is decomposed, than on the supposition that the ideas are transferred from the original matter of the brain to the new substance with which it is

being continually renovated; for if we conceive ideas to be composed of the organised matter of the brain, they must either be decomposed with the decomposition of that organisation, or we must suppose that the effect of that system of organisation is to create a new substance, that can exist when separated from the matter that called it into being. But — even putting out of consideration the arguments that have been previously advanced against such an imaginary self-creation — it is contrary to all known physiological facts to suppose that any portion of the substance of the human frame remains unchangeable; therefore we must presume that the supposed *matter of ideas*, if it be at all analogous to other material substances, would like them be speedily removed from the constitution of the body. We know, however, from the recollection of numerous by-gone events, that ideas are treasured up in the mind notwithstanding the decomposition of the matter that originated them; and though but a few, comparatively, of the impressions made on the sensorium during early life can be recalled, yet the recollection of a single one is sufficient to prove, that if the idea thus stored in the memory be a material substance, it must consist of matter differing altogether from that which enters into the general composition of the brain.

If it be supposed, then, that the *matter of*

ideas is distinct in its nature and properties from other material substances, the effect of such a supposition would, in point of fact, be to refer the perception of ideas to an agent distinct from the substance of the brain; and the theory of the materialists would thus become so closely allied to that which presumes perception, thought, consciousness, &c. to be the result of the action of a superior immaterial agent, that the difference between the two contending opinions would be confined merely to the abstract nature of this superior subtile agent.

The materialist assumes, that certain impressions on the brain produce by their action on that substance some other material creation, which possesses the power of perception. A combination of those sentient particles is supposed to form compound material particles, of thought, consciousness, volition, &c. These peculiar particles of matter must be presumed to exist independently of the organised matter of the brain, or they would otherwise participate in the changes of that substance, and with it would be entirely eradicated in the course of a few years. In tracing the progress of this imaginary process of causation, however, we are led several steps beyond the mere substance of the brain, and are supposed to have arrived at other material bodies, that possess powers essentially different from the matter of the brain in their

properties and durability. These properties, which the materialists ascribe to the existence of material thinking and percipient particles, the immaterialist supposes to reside in a superior subtile agent that receives the impressions of external objects from the brain, but is, abstractedly, as independent of that substance as the existence of the brain is abstractedly independent of the rays of light, that serve as the medium for the sense of sight.

The former opinion, that the faculties of perception and thought are performed by percipient thinking particles of matter, affords no more insight into the nature of those faculties than the supposition which refers them to an immaterial agent; and the former opinion is, also, involved in infinitely greater difficulties, and is much more opposed to the facts and reasonings that can be brought to bear upon the subject than that of an immaterial agency.

The mutations in the animal frame which we have hitherto considered, produce little visible alteration in the outward form, as the new particles of matter arrange themselves in nearly the same positions and shapes as those of the particles they supplant; but several of the smaller tribes of animated beings undergo changes which suddenly and completely alter their forms and habits of life.

All winged insects, previously to assuming

their perfect forms, pass through several stages of existence, altogether dissimilar to that in which they ultimately appear. The first state in which they present themselves, after bursting from the egg, is that of the lowest division of articulated animals; and they then resemble in their outward conformations the class of annelida, or vermiferous creatures. They contain, however, the embryo organs that are afterwards exhibited in the perfect insect. These organs are gradually developed and perfected as the larvæ increase, until, after having attained their full growth, the functions of vitality seem to be suspended, and the insect is seen encased in a hard substance, is without motion, and apparently dead. The vital functions are, however, during this semblance of death, continuing the developement of the embryo organs; and at length the shell is burst, and the insect, which had, during the former period of its life, crawled slowly on the surface of the ground, at once expands its wings, and rising from the earth, speeds its flight rapidly through the air.

Every species of winged insects undergoes similar changes; but the metamorphoses of those which previous to assuming their perfect shapes were aquatic animals, appear to be the most extraordinary. The larvæ of gnats, for instance, live in water until their organisation is completed, and they are ready to take wing and to leave the

scene of their preparatory state of existence for ever. The aquatic as well as the terrestrial larvæ are subjected to a state of temporary stupor resembling death, during the final process that prepares them for their perfect state of existence; and they emerge at once from the water and rise into a new element endued with enlarged powers and additional sensations.

Is it possible to conceive any thing more wonderful than these transformations? An animal which, from the first moment of its existence, has been accustomed to live in a dense fluid, and to subsist upon aquatic products — which has its vital functions and organisation adapted to such a state of existence, and which would die if removed from its aqueous element — this same animal, after having been enveloped for a short period in a hard inanimate substance, we perceive bursting forth in a totally different form, possessed of additional organs and new sensations, and furnished with powers adapted to its wants and enjoyments in a new state of existence.

The embryo organs of the perfect insect may be detected in the aquatic larvæ, but the mode by which those organs are developed is an impenetrable mystery; and when we consider, in addition to the changes that occur in the outward forms and internal organisation of the larvæ, that the instincts and propensities of the insect must be entirely altered, to enable it to

work the new machinery with which it is invested, the metamorphosis appears to be little less than miraculous.

The obvious reflection that suggests itself from the latter consideration of this subject, is the striking emblematical analogy which these transformations bear to another state of existence, wherein, after casting off the material form that binds man to the earth, he may enter into a new life, with enlarged and additional mental capacities, that may enable him to soar beyond the things of this world to regions of intellect and felicity at present unknown and inconceivable.

These transformations cannot, however, be adduced as bearing a strict analogy to the change which the sentient principle is supposed to undergo on the dissolution of the body; for in the one case, the process consists in the alteration of material substance from one form to another equally tangible; but, in the case of the dissolution of the body, the sentient being, on its separation from material organisation, is not cognisable to the senses. The transformation of crawling larvæ into flying insects may, however, be considered to bear as close an analogy to the presumed separation of the material from the immaterial principles of the human body as it is possible for any changes of tangible matter to bear towards those wherein one of the

agents is of a nature too subtile to be detected by our limited capacities; and they may be regarded as completely typical, at least, of the mysterious separation of the soul from the substance with which it is incorporated.

There is also another point of view, in which these transformations may be considered with advantage in reference to our general argument. The nature of the process by which these inscrutable changes are produced is entirely beyond our conception; and if we were without positive evidence of the fact, such changes would be considered, when viewed in reference to the ordinary phenomena of nature, as utterly impossible. The transformation, for instance, of a creature that can exist only in water, and that has no external organs whatever fitting it for surviving out of that medium, into a being furnished with wings that transport it through the atmosphere, provided with legs and other organs adapted for living in air, gifted also with instinct to make use of these newly-acquired powers, and incapable any longer of living in the medium which was previously necessary for its existence; — such a transformation, we conceive, if it were not confirmed by experience, would be regarded as more difficult to comprehend, and the supposition of such changes would be viewed as much more opposed to all "sound principles of philosophising," than the inde-

pendent existence of the sentient principle is considered to be by those philosophers who contend for the materiality of the mental faculties. We may thus derive from these insect metamorphoses another and a forcible lesson against the presumption of assuming those phenomena that are beyond the reach of our mental capacities to be beyond the reach of possibility.

The preceding considerations respecting the mutations in the structure of the human frame appear to lead us irresistibly to the belief that the sentient principle and the intellectual faculties must be distinct from, and, abstractedly, independent of, the ever-changing organisation of the body. The transformations of insects present us with a correct emblem in the material world of that change to another and superior state of existence into which the soul is presumed to enter, when its connection with the corporeal frame is dissolved; and though not, in every particular, analogous to that change, they resemble it as closely as it is possible for the mutations of corporeal frames to approach those of spiritual essences. And, lastly, these transformations are important, as additional and striking illustrations that the phenomena, which are daily occurring in the material world, are quite as inexplicable, upon any known principles of philosophy, as those connected with the separation of the ethereal principle of our nature

from its union with material organisation. In a threefold point of view, therefore, — first, as affording direct evidence of the separation of ideas from the matter that excites them — secondly, as a material emblem of a future and more perfect state of being — and thirdly, as affording an answer to objections founded on the supposed impossibility of such a separation and of such a Hereafter — the mutations in animal organisation furnish an important additional link to the evidence, that enables man to convert the fetters which bind him to this world into a chain of communication with the world to come.

The argument in support of the immateriality of the soul, founded on the mutations of animal life, has been thus forcibly stated by Lord Brougham, in his "Discourse on Natural Theology," published since the foregoing observations were written: — "The strongest of all arguments, both for the separate existence of mind and for its surviving the body, remains; and it is drawn from the strictest induction of facts. The body is constantly undergoing change in all its parts. Probably no person of the age of twenty has one single particle in any part of his body which he had at ten; and still less does any portion of the body he was born with continue to exist in or with him. All that he before had has entered into new combinations, forming parts of other men, or of animals, or of vegetable or mineral substances, exactly as the body he now has will afterwards be resolved into new combinations after his death. Yet the mind continues one and the same, 'without change or shadow of turning.' If the strongest argument to show that the mind perishes with

the body, nay, the only argument, be, as it indubitably is, derived from the phenomena of death, the fact to which we have been referring affords an answer to this. For the argument is, that we know of no instance in which the mind has ever been known to exist after the body. Now, here is exactly the same instance desiderated, it being manifest that the same process which takes place on the body, more suddenly at death, is taking place more gradually, but as effectually in the result, during the whole of life, and that death itself does not more completely resolve the body into its elements, and form it into new combinations, than living fifteen or twenty years does destroy, by like resolution and combination, the self-same body. And yet, after those years have elapsed, and the former body has been dissipated and formed into new combinations, the mind remains the same as before, exercising the same memory and consciousness, and so preserving the same personal identity, as if the body had suffered no change at all. Here, then, we have that proof so much desiderated — the existence of the soul after the dissolution of the bodily frame with which it was connected. The two cases cannot, in any soundness of reasoning, be distinguished; and this argument, therefore, one of pure induction, derived partly from physical science through the evidence of our senses, partly from pyschological science, by the testimony of our consciousness, appears to prove the possible immortality of the soul almost as rigorously as if one were to rise from the dead."

CHAPTER XXII.

PERSONAL IDENTITY.

THE consideration of the mutations to which the human frame is subjected seems naturally to suggest the inquiry whether the person who is continually undergoing these changes can, after a certain lapse of time, be the same being who formerly existed with a totally different bodily substance. Some speculative philosophers have gone the length of asserting the impossibility of personal identity, and have contended that the man of to-day cannot be the same as the man of yesterday, or of to-morrow. Upon this hypothesis it is contended, that the ever-varying states of material organisation in the body and the brain, must alter the constitution of the being subjected to such mutations; and, consequently, that he cannot be the same from one day to another; and, according to this mode of reasoning, we ought to conclude, as these changes are taking place every instant, that we do not continue to be the same beings for a single moment of our lives. The life of man, we should therefore presume, consists not of one continued existence, but of a series of innumerable separate existences.

The supposition that the man of one moment of time is not the same person as the man of the succeeding moment, inconsistent as it is with common sense, and opposed to our intuitive perceptions, seems to be the only hypothesis on which the system of the materialists can consistently be defended; for if mind consist of the substance of the brain, it must be perpetually changing with the material organisation of that substance. We endeavoured, however, to show in the preceding chapter that, even on the material hypothesis, the percipient agent must be sought for elsewhere than in the mere matter of the brain; and that that subtile agent — or supposed property of material organisation — when compared with the ever-fleeting materials which compose the brain, must be of permanent duration.

In contradiction, however, to the fanciful hypothesis that the individuality of man is destroyed by his organic mutations, we have the memory of former consciousness. The remembrance of certain actions in time past, and of the motives of those actions, and the recollection of the impressions which former events produced on our minds, all tend to prove — whatever changes our material organisation may have undergone since those sensations were excited — that we are still the same sentient beings who received those impressions.

No man, we believe, who possesses the use of his faculties, and who is able to recollect the leading events of his life, entertains the least doubt respecting his identity with his former self, though no single particle of the material substance that then constituted his bodily frame remains; and no one ever for a single moment felt less anxiety respecting the future circumstances of his life, from the consideration that the being who will be percipient of those future events will not be himself, but some other distinct percipient being, in whose welfare the present man can have no interest. If the future being who, it is thus supposed, is to assume our form, our thoughts, our feelings, and dispositions, together with the perfect recollection of the present and past circumstances of our lives and our motives of action — if such a future being be not identical with our present selves, and if the man of yesterday had an existence distinct from that which we now enjoy, the distinction cannot be appreciable by our faculties, and is utterly disregarded in all the practical relations of life. We might, indeed, by pursuing the subject into its abstruse recesses, show the fallacy and absurdity of the supposition that man has no identity with his former self; but such a course would lead us into metaphysical disquisitions not immediately connected with the subject-matter of our present consideration. It would

be found, that if we were to follow the denial of personal identity to its ultimate consequences, we should be obliged to deny that we exist; and if we deny that truth, upon which all knowledge is founded, it is useless to pursue any investigation farther.

The memory of former consciousness is sufficient to prove, not only that we are the same beings who existed at the period which we recall to mind, but that we must have continued the same during all the intervening periods; and the deficiency of such remembrance at any time in that interval cannot be reasonably considered to throw any doubt upon the continuity of the identity. Suppose that a man were to lose all recollection of the events of the last ten years of his life, but were to retain a strong impression of events in which he took an active part prior to that time; it would scarcely be contended, we presume, that during the intervening period of unconsciousness his identity was lost, and that it has again returned to him. If, therefore, we admit that the memory of consciousness constitutes identity, we must grant that from the earliest date of distinct recollection to the present act of thinking, our identity must have continued uninterruptedly.

If, indeed, it be disputed that memory of consciousness is sufficient proof of individuality, and if it, consequently, be doubted whether we ex-

isted yesterday, we may with equal reason doubt whether we exist to-day; and, as no evidence of any fact can be greater than that of the intuitive perception of our existence, scepticism upon this point would at once destroy the foundation on which depends the whole fabric of human knowledge — it would annihilate the impressions of the organs of sense, and would make all creation a non-entity.

There are other changes, however, besides those in the material substance of the body, that appear still more strongly to affect individual identity. The changes to which we allude are those continually occurring in our ideas and sensations. Every day adds to our stock of ideas, and circumstances are perpetually arising that tend to enlarge our views, and to alter our opinions of the questions that come under our consideration. A man who devotes much of his time to reading will be ever receiving new ideas, which have to be associated with those already stored in his mind; and the not unfrequent result of such an accession of ideas is to show that his previous notions were erroneous, and must be altogether discarded.

By the increase of our knowledge, the same impressions on the organs of sense excite very different sensations at different periods. When, for instance, a person hears an unknown language, the sounds strike upon the tympanum of

his ear without exciting any sensation beyond that of unmeaning sounds; but if he afterwards become acquainted with that language, and the same words are repeated, they may produce the most lively sensations. Our ideas respecting natural phenomena are, also, perpetually changing as we advance from infancy to maturity, and numerous objects that produced feelings of alarm and dislike in early life are afterwards regarded with approbation and pleasure.

The mutations in our ideas, which we have just noticed, are, for the most part, gradual, and are comparatively permanent; but the changes in our sensations are frequently sudden and evanescent, are generally intermittent, at uncertain intervals, and they often completely alter, for the moment, the character and feelings of the individual. Violent anger, for instance, seems for the time to destroy the reasoning powers; and, during its predominance, effects a total alteration in the feelings and ordinary dispositions, and suspends all the intellectual faculties that are not engaged in the immediate cause that excites the passion. The sensations of pleasure and of pain, of hope and of dejection, also materially affect our mental powers, and, whilst under their influence, the ideas excited by the same objects are exceedingly different; so much so, indeed, that if our feelings are analysed when the tone of the mind is restored to its

tranquil state, it will appear scarcely possible that the same being could have entertained sentiments so opposite respecting matters that are identical. Compare the views which a man in the buoyancy of health and hope takes of any proposed plan to advance his condition in life, with those which are taken on the same subject by the same individual, when he is labouring under some languid bodily pain, or is depressed by mental affliction; and the sentiments entertained on that, and indeed on most other subjects, under those different circumstances, will be so opposite that they will afford presumptive evidence against the identity of the individual entertaining them.

It will be found, however, upon reflection, that the mutations of our ideas and of our sensations afford no real countenance to the supposition that the individual is not the same; for in both cases the test of identity remains — the memory of former consciousness. Though our ideas may change, we have a recollection of a state of existence prior to the change; and though our feelings may undergo alterations, that either suspend for a time the exercise of our mental faculties, or diversify the nature of our impressions, yet we afterwards retain a consciousness of those changes, and in our calmer moments we remember the feelings that excited the bygone passion, or the state of exultation or mental depression

that induced us to take a bright or a gloomy view of life and its prospects. Indeed, if we were to assume that changes in our ideas or sensations are opposed to individual identity, we should be obliged, consistently with such an assumption, to admit that every new perception indicates a change of individuality; and in such a case, the life of each living being could consist of but one sensation, of one exercise of volition, and of but one action. It is useless to speculate further respecting such notions of non-identity; for, after all, even supposing that the individual living being of the present moment is not the same living being of the moments immediately preceding and succeeding, they are so closely connected that it is impossible for our faculties to separate their individuality, and the continuation of such a connection is all that we expect in this world, or hope for in the next.

There are, however, some considerations arising out of this subject that deserve further notice, as they bear directly on the general argument in favour of a future state of existence.

In the preceding chapter we were led to infer, from the duration of impressions made through the medium of the nerves and the brain, after the substance of the nerves and brain, and of the whole organised human frame, have been changed, that the percipient principle is distinct from, and less perishable than, the animal or-

ganisation by which it is brought into action. From the result of the foregoing reflections concerning personal identity, we learn to refer the various impressions on the sensorium to one percipient being, in whom the connection between the past, the present, and the future is preserved. The concentration of past perceptions must be produced not only by the retention of separate impressions made by the organs of sense, but by arranging, and comparing, and associating them with each other. This mental process is distinct from that of mere perception, and it serves to reduce the separate fleeting impressions to a connected permanent series of ideas and sensations, independent of the objects that were the original causes of those impressions. These ideas and sensations may also be subject to changes, but the power of consciousness, which enables us to perceive their existence, presides over all those mutations, and is cognizant of former ideas and feelings, contemporaneously with its apprehension of those of the present moment.

Of the nature of the power which thus individualises each separate sensation, and constitutes the essence of that being whom we call *self*, we can form no conception. We must, however, admit that there exists such a power, unless we are prepared to deny personal identity, and to contend that our perceptions, our memory,

our consciousness, and our very existence, are merely illusory, and that we ourselves, and all external objects, are non-entities. And if this power do exist, it must either constitute a part of the material organisation of the brain, or it must be a separate power, to which the organisation of the brain is merely subservient. Now, the results of our preceding considerations show, that even the organisation of the brain depends upon some power beyond itself; that the perceptive faculties must be distinct from material substance; and that the retention and association of perceptions almost necessarily implies the existence of a superior controlling power, by which they are thus preserved and arranged. We shall be obliged, consequently, to refer the operations of the mind to some presiding subtile agent, distinct from the mere matter of the brain; — an agent which continues the exercise of its powers after the combinations of the acting organised substances that excited it are dissolved; and which we may, therefore, reasonably presume, will continue to exert those powers after the present fleeting system of material organisation is entirely dissipated.

CHAPTER XXIII.

SUSPENDED ANIMATION.

THE views we have hitherto taken of the phenomena of life refer principally to the active exercise of the sentient faculties; we shall next proceed to the considerations which present themselves on an examination of the circumstances attending suspended animation. In entering this branch of our inquiry, we shall be invading one of the strong-holds of the materialists: we hope, however, to be able to dispossess them even of this position, and to show that those arguments against the existence of an independent immaterial principle, founded upon that close connection between the mind and body which the phenomena of sleep exhibit, have no solid basis, and that they are fully counterbalanced by the evidence which the same phenomena present in favour of the opinion that mind and matter are essentially distinct.

After continued exercise, the nervous stimulus which excites the muscular fibres to action becomes weak, the power of muscular contractility is exhausted, the muscles are relaxed, and the strength of the individual is prostrated.

The mental powers participate in the languor occasioned by the exhaustion of the usual stimulating energy, and they gradually sink into a state of repose. The perception of external objects is deadened; the powers of volition, thought, and consciousness are suspended; and the being who, but an hour ago, was full of animation and activity, and in the full exercise of his mental faculties, lies before us a mere living machine, insensible of external impressions, apparently devoid of intelligence, and without the power of motion.

During a state of profound sleep, consciousness seems to cease; and, as there is then no succession of ideas to mark the lapse of time, the waking moment appears to be separated but an instant from that of suspended animation. During this time, however, the vital functions have been performing their offices without intermission. The heart has continued to beat, the lungs to respire, the blood to arterialise and to circulate through the body, the stomach to digest and prepare the food for assimilation, the glands to effect their ordinary secretions, and the vital powers to appropriate and adjust the prepared materials in their respective transmutations to every part of the body. All the merely vegetative functions, in short, which tend to support and renew the corporeal frame, continue active,

whilst the mental powers are for a time suspended in a state resembling death.

From this state of lethargy the mind may be quickly roused to its former energy, by any sudden strong impression upon the organs of sense. A blow, a loud noise, a brilliant light, a powerful scent, or the application of a pungent substance to the tongue, will prove sufficient to dispel the charm that binds the faculties in the leaden bonds of sleep, and consciousness is at once renewed. If the sleeper be allowed to rest undisturbed, the insensible action of the vital functions will, in a few hours, restore the exhausted energies of the body; and when the organs of sensation, and the stimulating power of the brain, are prepared to resume their operations, the slightest external impression will awaken him from his slumber, with his bodily and mental powers invigorated.

Sleep is rendered so familiar to us by its constant recurrence, that we fail to be impressed with the very extraordinary nature of the circumstances that attend it, and which would otherwise be regarded by us as perfectly miraculous. What, for instance, can be conceived more calculated to excite our astonishment than a body devoid of consciousness or motion becoming in a moment, and without any manifest cause, an active being, endued with sensation,

with the power of volition, and beaming with intelligence?

If we were ignorant of such a state as sleep, and were, for the first time, to perceive an individual sinking gradually under its torpifying influence, until animation was completely suspended, we should conclude at once that the vital spark was extinct; and we should have no more expectation that the powers of perception would return to the apparently inanimate body, than we now entertain of the restoration of the vital functions to a corpse.

The restoration of perception after sleep does not, it is true, bear a strict analogy to the revival of consciousness after death; for, in the latter case, the corporeal organs, with which alone we are accustomed to associate the vital powers, are decomposed. The awakening of the mental faculties from their slumber, in an invigorated condition, may, however, be regarded as an accurate emblem of that more important transition, when the soul will awaken after the sleep of death, in another state of existence. The evidence of a future life, which the phenomena of sleep present, does not fail, we may reasonably presume, from the imperfection of their analogy to the circumstances attending death, but from the inadequacy of our corporeally connected faculties to apprehend the mysterious actions of immate-

rial agents. Being, as we are, utterly ignorant of the nature of consciousness, and of that power which actuates the vital principle, we are unable to discover the processes which, during sleep, enable the nutrient organs to discharge their functions, whilst perception and volition are suspended; and as we cannot understand the nature or the mode of operation of these subtile principles, during their union with material organisation, it is not to be expected that the limited intellectual faculties of man should enable him to investigate their properties and actions, when they are separated from their combinations with matter, through the medium of which alone they can now become cognizable to our senses.

The question which naturally suggests itself from the consideration of this subject is, What becomes of the power of consciousness in profound sleep? Consciousness implies the act of perceiving our own existence; and the active energy of the power by which that perception is produced. It is the result of the action of the percipient powers on the material organisation of the brain, and is, therefore, only an *effect* of the energy of that power, and is not a primary actuating principle. The state of consciousness has consequently reference only to the present act of perception; and it is not correct, in the strict application of words, to say that we are

conscious of past impressions: it is the *remembrance* of those impressions of which we have present consciousness. Consciousness, therefore, being but an effect of the percipient power, and having relation only to the time being, cannot be said to *sleep*; for that term implies the repose of some independent elementary principle. Dormant consciousness is, in short, as great a contradiction in terms as inert activity. The sense of consciousness may *cease*, when the percipient power by whose agency it is excited, fails to act on the material organisation of the brain; but it cannot sleep. The presiding power by which the effect of consciousness is produced is utterly inscrutable. We know that it acts through the instrumentality of the brain and the nerves with which it is connected; we know that there are two distinct nervous systems, the one subservient to sensation, and the other to volition, and that the former conveys impressions from external objects to the seat of the percipient principle, and that the latter are the agents by which that power exercises control over the muscles of the body; but we cannot ascertain the manner in which this action and reaction are produced. The action of the impressions from external objects on the sentient principle, and the reaction of that power on the nerves of volition, and on the organs of the intellectual faculties, constitute the sense of consciousness;

which depends, we thus perceive, on this exercise of the functions of the brain. When those functions are by any means suspended, the state of consciousness ceases; yet the power which acts upon the animal organisation, to produce that sensation, may continue in its pristine vigour, though it cannot be perceived, in our present state of existence, during the absence of the instruments by which it is manifested.

The foregoing considerations, respecting the agency of consciousness, are metaphysical speculations which do not come strictly within the province of the present work; but they are introduced for the purpose of showing, that the suspension of consciousness does not necessarily imply the absence of the power by which that sensation is produced. During profound sleep all consciousness of our existence is suspended; and the connection which subsists between this prostration of the mental faculties and the exhaustion of the corporeal energies tends, it must be admitted, on a superficial view, to countenance the opinion that matter and mind are identical. It therefore becomes the more necessary to examine the grounds on which this opinion rests, and to endeavour to prove that it has no solid foundation.

The question, it must be remembered, is not whether the mental faculties are intimately connected with corporeal organisation; for, unless

we are prepared to maintain, with the distinguished Bishop Berkeley, that matter has no existence, the evidence of the close connection between mind and matter is incontrovertible: but the real question is, whether the mind is so absolutely dependent on the body that it cannot exist when separated from the organised system of matter with which it is united. Does the suspension of consciousness during sleep, then, indicate this necessary dependence, and an indissolubility of the connection between the mental powers and the corporeal frame? We contend that it does not; and that the extent to which the evidence derived from it can fairly be applied only shows that the faculty of perception in our present state of existence is very intimately connected with material organisation;—a fact which no one who admits the existence of matter can fail to admit, after the least consideration of the phenomena of life.

So far, indeed, are the phenomena of sleep from affording proofs of the identity of matter and mind, that we conceive they may be advanced as evidence in support of the opinion, that the mind is distinct from, and may exist independently of, corporeal organisation.

In the first place, the suspension of the mental faculties, whilst the corporeal functions are in full activity, may surely be considered rather as indicative of a difference between, than as

proof of the identity of, those faculties and functions; for were they mutually dependent, we must suppose that the operations of the one could not be suspended without putting a stop to the actions of the other. Again; were the brain itself the sentient principle, we should conceive that the effect of corporeal exhaustion would be only to weaken the force of sensation, and not to extinguish it; and that, as the brain and nerves became invigorated by the renewal of their wasted substance, the mental faculties would gradually resume their wonted activity. We find, however, that the restoration of the exhausted powers of the brain is imperceptible until consciousness is revived at the moment of awaking; and then the power of perception resumes, in an instant, its operations, and not till then do we feel our mental faculties to have participated with our bodily organs in the refreshing influence of sleep.

If we presume consciousness to be excited by a distinct power, which is brought into action through the medium of material organisation, we can conceive that when the nerves and the corporeal organs have, from long exercise, been debilitated, the presiding power may become dormant; and that when its active operations on the material substance of the brain have been once suspended, the suspension of its energy may continue until some impression on the invigo-

rated organs of sensation rouses the dormant power. It is, however, impossible to conceive — upon the supposition that the sentient principle itself forms part of the material organisation — that the suspension of consciousness should continue after the bodily organs have been restored to their former vigour; for if the brain were sentient, we must conclude that consciousness would be gradually restored with the restoration of the strength of its exhausted organisation.

The circumstances attending the developement of the sense of sight by the visual organs may be adduced, as affording a correct illustration of the view we have taken in the preceding remarks respecting the power of consciousness, and its relation to the subordinate agents by which it is manifested. When the light is gradually diminished until all objects are invisible, no sensible impression is made on the retina. The nerves that are adapted to convey the impressions received on the retina to the brain then become inactive, because the medium through which alone they are brought into action is excluded. The optic nerve and the brain, nevertheless, retain their powers in full vigour, notwithstanding the absence of light; and when that medium is again admitted the sensation of sight returns. In the same manner, we may conceive the percipient power to continue in full vigour when the material organisation through whose instrumentality

alone its presence can be perceived during corporeal existence is either fatigued, impaired, or decomposed.

In whatever mode the suspension of consciousness is immediately produced, we can entertain no doubt that a deficiency in the stimulus of the media which excite the percipient power, is the cause of sleep. Those media are the nerves and the brain; and there is no more reason to suppose, from the consideration of the phenomena of suspended animation, that the substance of the brain is itself conscious, than there is to infer from the consideration of the phenomena attending the action of the organs of sensation, that the brain is sentient of sight, of hearing, of taste, of touch, or of smell. We have endeavoured, in preceding chapters, to show that those sensations are referable to some agent beyond the brain, and that the latter substance is, also, dependent upon some subtile agent *ab extra*, which presides over its organisation; consequently, if we have succeeded in establishing that perception, by means of the organs of sensation, must depend on the agency of some subtile principle distinct from the brain, we have strong grounds for assuming that the power which excites a consciousness of our existence is also independent of material organisation. But the phenomena of sleep, we contend, are not only consistent with the independent exist-

ence of the sentient principle in a state of separation from the body, but they tend to give additional confirmation to that position; for the action of the vital powers during the suspension of the powers of the mind, and the suddenness of the transition from a state of unconsciousness to that of mental vigour, clearly indicate, we conceive, that the mind is distinct from corporeal organisation, and that the latter is merely the medium by which the former powers are excited.

Sleep is not the only condition of the living body that is accompanied with a suspension of the mental faculties. In syncope the deprivation of consciousness is more complete; and it is accompanied also with the suspension of the vital functions. The pulsation of the heart ceases, the respiration is scarcely perceptible, the heat of the body frequently departs, and the continued suspension of the vital functions occasionally merges into death.

Fainting may be induced either by the action of the body on the mind, or by the action of the mind on the body. The loss of blood, or acute pain, are either of them sufficient to cause a suspension of the sentient powers; sudden fright, or the hearing of distressing intelligence, may also produce the same effect: the two former are instances of the suspension of the sentient powers by the action of the corporeal organs on the mind — the two latter, of the action of the

mind on the body. The deprivation of consciousness by loss of blood, or by great pain, may be attributed to the altered condition of the organised substance of the brain, produced directly by the altered condition of the body; or to the violent action of the sensorial nerves, which enervates or disables that organ from continuing to serve as the medium for the exercise of that faculty: — the machinery has been disarranged, and the moving power, to which the machine was expressly adapted for the production of given effects, cannot manifest itself until the parts are re-adjusted, though the power itself has not been diminished nor affected by the disorder of its subservient instruments.

This peculiar action of the body on the mind points out the close connection subsisting between corporeal organisation and the exercise of the mental powers; but it cannot be considered to present any greater evidence of the necessary dependence of the mind on the body, than that afforded by the suspension of animation during sleep, which we have already investigated. The principal difference between the two cases is, that in swoons the functions of the body participate with the mind in the suspension of its powers.

Those instances wherein the suspension of the vital functions is caused directly by the action of the mind, furnish very remarkable evidence to

prove that the body is only the subservient agent of the mind. Let us consider, for a moment, in what manner fainting can be caused by sudden fright. In these cases, the sensation is usually conveyed through the visual organs to the brain. The rays of light from some dreadful object, or from the agents in some revolting action, strike upon the eye, and are transferred by the optic nerve to the brain, and excite perception of the images impressed on the retina.

Let us suppose, for instance, that a person who is susceptible of superstitious impressions awakes at midnight, and perceives at his bedside a horrible figure, with a ghastly visage, and clothed in the imaginary habiliments of a ghost. The shock produced by such a sight would most probably deprive the spectator of sensation.

Now, what can have caused this effect? It cannot be attributed to the mere impression communicated to the brain by the rays of light proceeding from the object; for the same figure, if viewed in the day-time, or under other circumstances, might not excite the least alarm. The effect must be produced by associating the appearance of such an object with our preconceived notions of supernatural agency, and the mysterious dread of some unknown and inconceivable danger must operate on the organs of sensation with such extreme violence as to suspend the action of the brain. That organ

becomes then incapable of performing its accustomed functions; and this sudden revulsion not only suspends the exercise of the mental faculties, but paralyses the nerves that are subservient to the vital powers, and puts a stop to their operations. Similar effects may be produced by certain impressions on the other senses; but, in every case, they result, as in the foregoing instance, from certain associations of ideas connected with the impressions made by the organs of sensation, and arise altogether from the operations of the mind, distinct from the simple impressions that excite them.

The vital powers are thus liable to be suspended by any strong, sudden impulse of the affections of the mind, derived originally from impressions totally inadequate—when viewed apart from the existing association of ideas—to produce any effect whatever on the functions of the body. When we perceive, therefore, the same cause producing at one time no effect on the animal frame, and at another time acting with sufficient force to stop the operation of the vital functions, and even, in some cases, to extinguish them altogether, we may reasonably conclude that the sentient principle cannot be a mere material agent, subject to the undeviating laws which regulate the actions of material bodies on each other.

The line of demarcation between syncope and

death is frequently so faint as to be scarcely perceptible. The external appearances are nearly the same; but, in the former case, the vital spark is by some inscrutable means preserved, and the body and mind are restored to their former energies. We cannot ascertain in what manner the power of consciousness can be retained in the inanimate form, to be restored to action with the renewed exercise of the vital functions; and we must necessarily, from the utter incompetence of our faculties to comprehend the nature of a subtile immaterial being, remain ignorant of the mode by which the soul can exist when disunited from material organisation. The operation of the mind, on recovering from a swoon, is renewed without our being able to form the most distant idea of the manner by which this restoration of consciousness is effected; and if we are unable to discover the nature of this mental process when operating within our bodies, it is irrational to expect that we should be able to ascertain the mode by which the power of consciousness is preserved in a state separate from that system of material organisation in which alone we have knowledge of its existence.

The principal argument, however, against the existence of the soul apart from corporeal organisation, resolves itself into our incapacity to comprehend such a state of being. But if we were to assume the extent of our comprehension

to be the boundary of possibilities, we must restrict our belief within a very limited compass; for innumerable are the phenomena of inanimate matter, as well as the phenomena of life, that baffle the intellectual powers of man, and show his inability to apprehend the causes of the simplest processes that are continually operating around him. The objection, therefore, that is founded on the inadequacy of the intellectual powers of man to comprehend how the mind can exist distinct from a system of material organisation similar to that with which we are accustomed to see it connected, ought not to be entitled to the least consideration; whilst the amount of direct and analogical evidence which can be adduced to prove that the mind is distinct from, and may exist independently of, the body, is, we contend, sufficiently strong to counterbalance all objections that may be urged against an immaterial sentient principle, and to leave a vastly preponderating weight of evidence in confirmation of the belief in a future life.

CHAPTER XXIV.

DREAMS AND SPECTRAL ILLUSIONS.

In the preceding considerations respecting the state of suspended animation, the power of consciousness was regarded as participating with the organs of sensation in their temporary slumber, and as being almost necessarily suspended on the cessation of the perception of external objects. We took this view of the question for the purpose of considering, under circumstances most favourable to the material hypothesis, how far the observed mental and physical phenomena attending the suspension of that power in profound sleep, and during syncope, were applicable in favour of or against the immateriality of the sentient principle. We endeavoured to prove, that even in this view of the question, the inferences to be deduced from it were so far from being opposed to the existence of a separate immaterial principle, that they tended to confirm the evidence we had previously advanced in support of that position.

If we are enabled to arrive at conclusions favourable to the belief of the independent ex-

istence of the sentient principle from those phenomena which exhibit the intimate connection that subsists between that principle and the active exercise of the organs of sense, we shall be able to arrive at a still more satisfactory conclusion from the consideration of the phenomena of dreams; wherein the power of consciousness is active independently of external impressions, — the idea of motion is excited without any relative change of place — and wherein thought, and memory, and the other intellectual faculties are exercised, the passions are roused, and a new scene is opened to view, without the immediate aid of those organs of perception that serve to connect us with the external world.

The limits of our knowledge are too confined to enable us to ascertain with any precision the means by which dreams are produced. They seem to be the result of an intermediate state between profound sleep and the active exercise of the perceptive faculties; and dreams are seldom perceived when fatigue conduces to sleep, in a healthy state of the body and a tranquil condition of mind. Though the causes of this intermediate state of existence lie concealed behind the impenetrable veil that enshrouds every mental process, many of the impressions that are made during its continuance remain after waking, and afford ample materials for interesting specu-

lation respecting the operations of the mind. It is not our province, however, to pursue this inquiry beyond those leading points that tend towards the elucidation of the subject we have in view.

Every one who has paid attention to the phenomena of dreams must be conscious that, during the continuance of dreaming, the forms and colours of objects, and their motions, are clearly distinguishable, and are impressed with a vividness which, at the time, produces the idea of reality. The idea of solidity, corresponding with the sense of touch, is also excited; sometimes a sensation resembling the sense of taste arises in the mind; and sounds, apparently proceeding from distant objects, seem also to strike upon the ear. During our dreams we frequently behold objects that are different from any of which we have recollection in our waking hours; we hear sentiments expressed which are opposed to our own, and endeavour to controvert imaginary arguments; we find ourselves also moving, in idea, from place to place; we frequently suppose ourselves to be in vigorous action; and we are often in fancied collision with some personal antagonist. Our sentiments and sensations are usually, in dreams, the same as when awake; and though we must represent in our minds all the beings who take part in the scene — must furnish them with words, and enter, in some de-

gree, into their feelings — we have no distinct internal consciousness of the existence of any other persons than ourselves. The dread of personal injury seems even more prevalent in dreams than at other times; and the alarm of some impending danger is frequently the cause of rousing us from our disturbed slumber. The imaginary scene in which we are actors generally interests us as much as that of the real theatre of life; and on awaking from a very vivid dream, we experience a temporary difficulty in recalling our ideas from their abstract world to the material scene around us, and we cannot, for a few moments, remember where we are.

The ideal lapse of time, during dreams, is not the least extraordinary circumstance attending this peculiar state of the mind. Days, and occasionally even years, are supposed to have passed away during the short interval of sleep. We sometimes dream that we are asleep, and engaged in the scene of another dream, from which secondary state of dreaming we seemingly awake to enter again into the action of the original dream; being, in both cases, perfectly unconscious that during the whole time our percipient organs are inactive.

It appears, from the foregoing notice of the principal phenomena of dreams, that the powers of consciousness, of perception, and of volition, with the

faculties of thought and judgment, are in active operation, whilst the ordinary communication of the perceptive faculties with the external world is cut off; and the ideal state of existence which dreams disclose, seems to be an exact counterpart of reality in its sensations and motives of action. The question, then, arises, how can these perceptions be excited without the agency of the material organs by means of which alone they can be produced when we are not asleep? The effect may be attributed, in a certain degree, to the operation of the powers of memory; but the exercise of memory alone would not account for the phenomena, for the actions in which we are apparently engaged are seldom mere repetitions of those which have previously occurred.

Though it cannot be supposed that during the time the energies of the organs of sensation are suspended we can receive any fresh impressions, yet the power of combining those impressions already received into different forms must be in active exercise, so as to produce from the old materials the effects of entirely new impressions. The perception of these new combinations implies the action of the perceptive power; and the ideal plans we adopt, in consequence of those perceptions, indicate the operation of thought and judgment. Memory provides the crude materials of our dreams; but they are wrought

into their varied forms by the combined operation of the intellectual faculties.

To be able to see without the eye, to hear without the ear, and to feel without touching the objects of sensation, would, we may venture to assert, have been considered utterly impossible, if we had not experience of the fact from the effects of imagination and of dreams. These facts, we contend, afford direct proof in support of the position before advanced, that the percipient principle is independent of the organs of sense; and they lead us to infer, also, that the material organisation of the brain — by which the impressions of external objects are originally conveyed to the mind — must be distinct from the power that receives and retains those impressions: for it would be impossible otherwise to account for the activity of the perceptive power during the time that the brain ceases to hold any direct communication with the material world. The same reasoning will apply, with even greater force, to the intellectual faculties, which are exercised upon those ideal perceptions; and as the action of memory, of perception, of thought, and of judgment, necessarily supposes consciousness of those mental operations, it follows, as a necessary consequence, that the power of consciousness also must be independent of the organised matter of the brain.

It may perhaps be objected to this conclusion, that as dreams do not occur in profound sleep, the ideas in that state of the mind may be excited by the partial operation of the material organisation of the brain. Admitting this to be the case, it would not militate against our argument; for we have never assumed that the operations of the mind can, during its intimate connection with organised matter, be carried on without the aid of its corporeal mechanism. The evidence to be adduced from the phenomena of dreams goes to this extent: — it proves that ideas similar to those produced by the action of material organs may result from the mere operation of the mind, without the agency of those organs. It fails, indeed, to prove that those mental operations can be performed without the material organisation of the brain; but having shown that the effects of the complicated machinery by which all our knowledge is gained may be repeated without the aid of the original instruments of sensation — having shown that the mind can dispense with material organs in those instances wherein their adaptation to the production of certain known effects is more particularly cognizable to man—analogy leads us to infer that the more inscrutable operations of the mind, which cannot be traced to the agency of any separate material organs, may

exist independently of the organised system with which the intellectual faculties are connected.

Spectral illusions afford instances even more conclusive than the foregoing of the distinct natures of the mind and the organs of sensation. In these cases, not only are the impressions produced without the immediate aid of the organs of sense, but in direct opposition to the impressions which those organs are calculated to produce; for the image viewed by the mind is sufficiently vivid to obliterate the impressions made upon certain parts of the retina by the rays of light from external objects. In dreams, the whole scene is illusory; and the perceptive faculties being inactive, there are no disturbing causes to influence the workings of the imagination; but in cases of spectral illusion, as the perceptive faculties are in active exercise, the mental vision is more subject to be disturbed by external impressions from the organs of sensation, and unless the ideal image be extremely vivid, it will be obliterated by the impulse of the rays of light proceeding directly to the eye from surrounding objects. In certain states of the mind, however, the ideas which are excited by its internal operations are more powerful than the impressions conveyed to the sensorium by the ordinary action of the nerves, and overcome the direct action of light on the retina of the eye.

It is well known, for instance, that in certain

states of the brain and nerves images of objects not present are perceived by the mind with a distinctness equal to reality. Now, when a person in the full exercise of his faculties perceives a figure which has no tangible existence, such an illusion requires for its production not only an impression to be made on the mind sufficiently strong to excite the idea of the apparition, but also of sufficient power to efface the impressions conveyed to the retina by the rays of light issuing from the objects that the apparition seems to conceal from sight. For, suppose the figure appear to be standing near the wall; then as every ray of light from the wall that previously produced an impression on the retina continues to act with a force equal to that imparted before the figure was seen, those rays which proceed from the points apparently covered by the apparition must, in some manner, be prevented from producing their accustomed impressions on the mind. Were this not the case, as there is in reality no object between the eye and the wall, the perfect vision of every point sending forth rays of light would preclude the possibility of the perception of any illusion. It must be evident, therefore, that in all spectral illusions visible in conjunction with real objects, the mind must possess the power of seeing not only images which have no tangible existence, but of seeing

them also in opposition to the direct impressions of the perceptive organs.

The simultaneous perception of real bodies and of mental visions seems to arise from the same act of the mind; and yet the causes of these perceptions bear not the least resemblance to each other. In the one case they arise from impressions produced by material objects acting on the organs of sight; and in the other case they originate in the mind, without any communication whatever with the external world. Now, when we perceive the same effect which is produced by the agency of material organs communicating with external objects, to be excited, at the same moment, by the internal operations of the mind alone, we cannot fail to admit that the faculty of perception is independent of the mechanism of the eye and of outward material forms; and when we ascertain, further, that the mental vision may be sufficiently powerful to efface the impressions conveyed to the brain through the organs of sensation, we must conclude that the images formed by the mind may be more vivid than the impressions received through the ordinary media of sensation. These facts, therefore, tend to confirm, in the clearest manner, the evidence derived from other sources, that the mind is independent of the

material organs, by the agency of which all our fundamental ideas are received.

The objection that may possibly be urged, on the ground that spectral illusions are only the results of a diseased state of the brain, does not, so far as our present argument extends, invalidate our inferences; for if the ordinary effects of the organs of sensation can be produced, in any state of the brain, without those agents, that fact is sufficient proof of the capability of the mind to act independently of the material instruments which are specially provided for communicating to it the impressions of external objects.

The consideration of that state of the brain which renders the mind peculiarly susceptible to internal emotions is a physiological question, and is distinct altogether from those views respecting the faculties of the mind to which the knowledge of its independent power of perception gives rise. If we were to assume that spectral illusions are caused by an increased stimulus given to the material organisation of the brain, the only inference to be drawn from such an assumption would be, that the activity of the perceptive power increases in proportion to the increased energy of its material agents. Were we to take for granted that this hypothesis is correct, the supposition would not weaken our argument

in support of the independence of the mind; for as we have in all our views of the perceptive and intellectual faculties considered them as being brought into operation by the agency of the material organisation of the brain, the intensity of their powers must necessarily depend upon the state of the machinery by which they are brought into action. But though the mind may and must be affected in its modes of operation by the condition of its corporeal machine, there is no more reason to regard this sympathy between the mind and the body as indicative of the absolutely necessary dependence of the former on the vitality of the latter, than there is to imagine that the existence of heat depends on the continued action of the machinery of the steam-engine, by the agency of which the expansive power of that subtile property of matter is exerted.

Could we, indeed, establish the fact of the mind operating entirely apart from matter, we should be able at once to dispose of the whole question; but our very limited faculties will not permit us to penetrate into the subtile properties of abstract etherial essences. Though the phenomena of dreams and of spectral illusions do not represent the perceptive faculties to be capable of acting when separated altogether from the corporeal machine, yet we conceive that the

proofs which they exhibit of the agency of the perceptive powers, not only without the aid of the organs of sensation, but in direct opposition to the impressions which those organs convey to the brain, are sufficient to establish the abstract independence of the mind.

CHAPTER XXV.

GENERAL SUMMARY.

THE circumstances under which alone our corporeally connected faculties will enable us to apprehend any state of existence, are necessarily so intimately blended with animal organisation, that we are placed on very disadvantageous ground when we endeavour, by investigations into the nature of that connection, to establish their separate and independent existences. As the body is the residence of the sentient and thinking principles — as every sensation we receive proceeds from material substance, and is communicated to the mind through material organs — as every conceivable indication of life and intelligence must be conveyed by means of material agents — the phenomena of life seem, indeed, at first view, to present evidence directly opposed to the existence of the sentient principle in a state separate from animal organisation. We can form no idea of existence unconnected with the sensations conveyed by the organs of feeling, seeing, hearing, taste, and smell. Each of those sensations is communicated through the medium of an organised system of matter; nor can we imagine how such impressions could be

produced, otherwise than by agents similar to those employed. We are, consequently, necessarily compelled, in our inquiries into the nature and properties of mind, to be satisfied with investigating it in combination with the material organisation with which it is so intimately united.

These considerations will serve to show the difficulties which must attend any attempt to discover the mysterious connection by which mind and matter are linked together; especially when we endeavour to derive, from their apparently inseparable union, evidence to prove that they are distinct and independent principles. We trust, however, in the view which has been taken of the phenomena of life, that we have overcome those difficulties, and succeeded in establishing the independence and pre-existence of the sentient principle; and that we have shown, that in those cases wherein any deficiency occurs in the chain of evidence, it arises rather from our mental incapacity to comprehend the mysterious subtilties of the human mind, than from any deficiency in the nature of the proofs to be adduced. The analogical evidence afforded by the consideration of the phenomena of life, also, confirms and strengthens that which is attained by induction from particular physiological facts; and we contend that the combined proofs presented in this branch of our subject alone, are

sufficiently strong to establish the conviction of the existence of the mind as a separate and independent principle; and that, if evidence equally conclusive were advanced in support of any system of physical science, the system so supported would not fail to meet with implicit belief.

The leading positions we have endeavoured to establish in our views of the phenomena of life are: —

First, That the living principle exists prior to, and is, therefore, not consequent upon, animal organisation.

Secondly, That the sentient and thinking principles are distinct from the material substances with which they are united; and,

Thirdly, That the intellectual powers of man exist independently of the system of material organisation by which they are developed.

To support the first position, we directed our attention to the origin of the living principle in vegetation, and in animal organisation, with a view to ascertain the first cause which actuates the organisation of matter. In pursuing this inquiry, we found that the changes which take place in inert matter, disposing it to enter into organic arrangements, are effected by some process entirely distinct from any physical cause with which we are acquainted. This process depends, indeed, upon chemical agency for its

first developement; but there is no perceivable relation to chemical action in its mode of operation, nor in its effects. In the first stage of germination, for instance, the chemical affinities subsisting between the moisture of the earth and the external coats of the seeds, produce a mutual decomposition of their respective parts; and the hydrogen, carbon, and oxygen are, by these means, presented in those states which are best adapted to their conversion into portions of the organised system of the germinating plant. But the chemical action does not extend beyond this preparation of the food for the future plant; and we are obliged to look elsewhere for the cause that arranges the prepared elements into their organic forms, and endues the organic particles with an active principle, capable of disposing other particles into similar forms, and of also communicating to them their peculiar properties of organic life. These effects are unlike those produced by any known properties of matter; and we are obliged to refer the cause to some source concealed by its subtilty from the comprehension of man. This cause begins to operate as soon as the elementary substances that enter into the composition of plants are prepared for its action. Of the nature of this agent we can form no conception. We know, however, from its effects, that such an agent exists; and every accretion of organic particles that succeeds the

first developement of the germ can be attributable only to the extension of the original operating cause to each particle of matter after it is organised.

We cannot rationally suppose that the effect of vegetation is produced without any cause; we must, therefore, conclude that the vegetative principle exists prior to the organisation of the plant; and that this organisation being merely the effect of the active operation of that principle, it cannot create the cause by which it is produced; — in other words, the vegetative process is not caused by vegetation, but by some occult actuating power, which exists independently of the plant in which its effects are developed.

The conclusions at which we arrived from the investigation of the phenomena of vegetation, were strongly confirmed by the consideration of the more complex structure of animal organisation. The existence of some power adequate to the assimilation of the food, and to the arrangement of the materials in their varied forms, and also capable of imparting to those particles the principle of vitality, by means of which they are enabled to take part in discharging the functions of the numerous animal organs, was shown to be absolutely necessary before any of those wonderful effects could be accomplished. The growth and sustentation of the human frame were shown to be owing to causes existing prior to

each augmentation and renovation of organised matter; and that any system of organisation — viewed abstractedly as a peculiar arrangement of the particles of matter — was utterly inadequate to effect the organisation of other particles of matter, without the aid of some pre-existing active principle capable of imparting that property to the inert particles.

The arguments advanced to prove that animal organisation depends upon the operation of some pre-existing, subtile cause, was found to be equally applicable to the vital principle, by the mysterious operation of which all the functions of the body are discharged. Whether or not that subtile agent — by whose means the pulsations of the heart, the inspirations and expirations of the lungs, and the innumerable secretions consequent on those actions are effected — be the same operating cause which regulates the accretions of matter in the organisation of the human frame, we cannot determine; but that some power exists competent to work the animal machine we must admit. To assume that power to be created by the system of organisation which itself must be the primary agent in producing, would involve the absurdity of transposing cause and effect; and we cannot, therefore, avoid coming to the conclusion that the vital principle exists prior to, and does not depend

upon, the system of organisation which it constructs.

Having thus, we trust, satisfactorily established our first position — that the living principle must exist prior to, and is not consequent upon, animal organisation — the distinct nature of the sentient and thinking principles from the matter with which they are united, and the separate and independent existence of the intellectual powers, might have been affirmed from analogy alone. But, independently of the analogical evidence which the pre-existence of the vital principle affords, we have derived, from several phenomena of life, direct testimony in support of those positions, as conclusive as the nature of the subject will allow.

To prove that the percipient and willing principles are distinct from the material substance with which they are united, our inquiries were directed to the principle of animal life, to the functions of the organs of sensation, and to the phenomena of animal mutations; and these investigations led to the conclusion that the subtile principle which animates the human frame, and the perceptive power, are distinct from matter; and that the material organs are only subordinate agents which communicate the impressions from external objects to the immaterial mind.

As we ascended the scale of animal life, and proceeded from investigating the connection of

the vital and sentient principles with material organisation to the consideration of those phenomena which evince the operation of the intellectual powers, the distinction between those powers and material organisation were still more apparent, and they also were shown to exist independently of that organisation.

The phenomena of animal mutations, for instance, exhibit the powers of consciousness and memory, and the faculties of thought and judgment, as capable of being transferred from one system of material particles to another without participating in the changes that take place in the physical constitution of the organs by which they are developed, even when all the particles of matter with which they were connected have been changed.

In our consideration of the subject of personal identity we were led to observe, that the mutations in our ideas and sensations at different periods of our existence, whilst the memory of former consciousness remains, renders it necessary to refer the various impressions on the sensorium to one percipient power, by which the connection between the past, present, and future is preserved; and as that power continues immutable in its essence, notwithstanding the variety of changes in the ideas and feelings which it apprehends and associates, we can form no other conception of its nature than as

distinct from, and independent of, the ever-changing material organisation with which it is combined.

Our inquiries into the phenomena of suspended animation and of dreams, also tended to show that the functions of animal organisation are distinct from the percipient and intellectual faculties; and that whilst the percipient power may operate without the aid of material organs, the intellectual powers may be exercised upon those immaterial perceptions.

If we have succeeded in proving those three leading propositions which it has been our object in this branch of our inquiry to establish, and have shown that prior to the formation of any organised system of matter there must exist some subtile active agent competent to originate and to regulate the process, — that the sentient principle is distinct from material substance, — and that the intellectual powers are, abstractedly, independent of the material agents by which they are developed — we shall have derived from physiological science every possible evidence which it could be expected to afford in support of the argument for a future state of existence.

If the vital principle exist before the system of organisation in which its energies are displayed, we may rationally presume that the sentient and thinking principles — which have been

shown to be distinct from the material organs — must also have existed before the developement of those material agents which are subservient to the exercise of their powers. If we were to deny their pre-existence, we should then be obliged to assume that an organic system of matter is capable of creating subtile agents which are distinct from and independent of matter itself; — agents, too, which possess the power of controlling material organisation, and for the use of which that organisation is constructed. We should, according to this hypothesis, be driven to the absurdity of assuming that inert matter, which can act only by the stimulus of a pre-existing power, can create the active principles which are to regulate its motions; and that the instrument can create the agent by which it is employed.

The pre-existence of the intellectual powers might, indeed, be inferred from their distinct and independent characters alone, and that conclusion seems to be a necessary consequence of the admitted pre-existence of the living principle: for whether that principle be distinct from the intellectual powers, or whether it be a modification of the same subtile agency, if we admit the necessary pre-existence of an active subtile principle to effect the organisation of matter, we must equally admit the pre-existence of the powers for whose developement that organisation is formed.

We may also infer, from the foregoing considerations, that if the sentient and intellectual principles exist prior to, and independently of, the system of organisation in which they are subsequently developed, they will continue to exist after that organic system is destroyed. We cannot, it is true, form any conception of a state of existence independent of the body. All our ideas are derived originally through the medium of corporeal organs, and it is as impossible to imagine any sensation distinct from the animal frame as it is to conceive the nature of a new sentient power. No one, however, we believe, will be presumptuous enough to adduce his inability to comprehend the nature of other senses than those he possesses as an argument against the possibility of additional senses being imparted to percipient beings; and our incapacity to apprehend the nature of a future state of existence ought not, therefore, to be considered a rational objection to the immortality of the soul. The incompetency of our mental powers to examine the first causes of the simplest processes of Nature, have been frequently pointed out in the course of our inquiries; and in no instance is this incompetency more evident than in our endeavours to arrive at the first causes of the phenomena of life. We are baffled in all our attempts to penetrate the inscrutable mysteries which every where surround us; and can we hesitate to admit that

the mysterious processes of intellectual vitality — the connection of which with the animal organisation we cannot understand — may be carried on in other states of existence at present unknown?

The numerous analogies which the phenomena of life present, tending to confirm the belief in a future state, must not be omitted in a summary of the evidence afforded by this branch of our subject. We do not, indeed, lay much stress upon mere detached symbolical analogies, unsupported by corroborative testimony; but when physiological changes, that are analogous to those which may be presumed to occur on the separation of the immaterial spirit from material substance, are accompanied by other facts, which serve by well-sustained induction to give additional confirmation to the analogy, those analogous instances become important as correlative evidence; and they are also valuable as exemplifications that changes are continually being wrought in the constitution of living bodies, which are only less wonderful than those we anticipate on the dissolution of the corporeal frame, from the circumstance that they are become familiar by frequent occurrence.

In this point of view, therefore, the annual decay and renewal of vegetation — the mutations and metamorphoses of animal life — and the restoration of suspended animation — are deserving

of consideration; not only on account of their symbolical analogies to the resuscitation of the soul after the dissolution of the body, but because they afford illustrations that analogous changes are constantly taking place equally as incomprehensible, and which, if presented to us for the first time, would appear equally as miraculous, as those which we affirm respecting the material developement and the immaterial existence of the human mind.

CONCLUSION.

THE proposed object in commencing the present work was to elicit, from the investigation of the laws and properties of material substances, and from an examination of the relations subsisting between mind and matter, evidence to prove that the subtile qualities of bodies, and the ethereal essence of mind, are separate entities, distinct from, and independent of, mere inert matter; and to deduce from these premises the existence of the soul, independently of the body. With this object in view, we have endeavoured, as strictly as possible, to confine our observations to those phenomena that are connected with the physical sciences, and to abstain from entering the region of abstruse metaphysics. The phenomena of matter and its properties, and of the combinations of matter with mind, are those alone which have been considered proper subjects to be adduced as "natural evidence" in support of our argument. It is impossible, however, from the nature of these inquiries, to avoid altogether metaphysical speculations, though they have seldom been introduced excepting in connection with material phenomena, or as illustrations of the actions of

the mind on the functions of the body. Having, therefore, with this limitation, taken a survey of some of the more striking properties of organic and of inorganic matter, it remains for us to examine the results of our labours, and to show that the evidence collected is more than sufficient to counterbalance all opposing arguments against the belief in a future life, founded on the connection between mind and a system of material organisation; and that it affords satisfactory proofs of the independent existence of the soul.

The inherent quality of matter that was first exemplified was its indestructibility. Numerous instances were adduced of the apparent destruction of matter, from the simple process of solution to that of combustion; in all of which it was shown, that even when the annihilation of matter seems the most complete, the elementary particles of the substances operated on suffer no diminution nor change, but have merely entered into different arrangements. The processes themselves which are commonly considered the most destructive, instead of being active destroying powers, were shown to be merely the *effects* and not the *causes* of chemical action. Combustion, for instance — which is usually viewed as the most active of all chemical agents — was found to be the result of the close affinity subsisting between oxygen and hydrogen; and that

those gases, on entering rapidly into combination, liberate or excite the heat that accompanies their union; the evolution of the heat and light being *subsequent* to the change which takes place in the elementary condition of the two gases, and only an *effect* caused by the energetic chemical action. Every other apparently destructive process which we are enabled to examine was also found to be the result of similar attractions; and the indestructibility of matter by any known chemical action was satisfactorily proved, first, by analysing the results of those processes considered most destructive; and, secondly, by showing that the processes themselves are merely the effects of antecedent changes, produced by chemical affinity.

Having established our first proposition — that the elementary particles of material bodies cannot be annihilated — we next proceeded to investigate the general properties of matter, and took under examination most of those essential attributes which govern and regulate inert substance. Our inquiries into this branch of the subject led to the conclusion that light, electricity, chemical attraction, gravitation, and all the other properties of matter, are distinct from inert matter itself, and that those subtile agents exist independently of the material particles by whose means their actions are developed.

Among the numerous illustrations of this fact that were presented during the investigation, those connected with the nature and properties of light may be regarded as peculiarly forcible. The presence of light, it was observed, is only perceptible to the eye when the rays fall directly on the retina from the luminous object. Under all other circumstances light is invisible. It was shown, however, to be independent of the objects reflecting the rays to the eye; and that it continues to exist undiminished, though imperceptible, when the objects that reflect, modify, and partially decompose its rays, are removed or apparently destroyed.

Instances equally conclusive, if not so immediately obvious, were adduced, in treating of the other properties of matter, to prove that they are subtile agents, independent of the substances with which they are combined; and it was inferred — from the evidence of experience in some cases, and from well-founded analogy in others — that all those subtile properties which actuate inert matter are equally indestructible as the matter they control.

After considering the properties of inorganic matter, we proceeded to examine the phenomena of life. In viewing the new relations in which matter presents itself during the organic processes, we were obliged to admit the accession of

some additional subtile principle, distinct from any of those properties previously investigated. The necessary pre-existence of this organic principle, and its independence of any system of organisation, were clearly deduced from an examination into the origin and maintenance of organised arrangements.

The mysterious connection subsisting between organised matter and the sentient and willing principles was particularly investigated; and those principles were shown to be independent of the organs of sensation by which their powers are developed. We were also enabled to deduce from the unchangeable character of the power of consciousness, and from the retentive powers of memory, that the intellectual faculties are distinct from the ever-changing material substance of the human frame. Assuming that those faculties of the mind participate in the attributes which pertain to the agents that subserve the purposes of their developement, we inferred, from the established pre-existence of the organic principle — from the action of the perceptive faculties independently of the organs of sensation — and from a variety of analogous phenomena tending to confirm the presumed independent existence of the living principle — that the mind must also exist prior to, and be independent of, as well as be distinct from,

the organised material system with which it is united.

This retrospection of the principal results of those inquiries to which our attention has been directed comprises the leading features of the direct evidence that has been adduced in support of our general position. That position does not depend upon isolated facts, but on a variety of concurrent testimonies in each department of our inquiries. The important question, therefore, to be decided is — are the inferences drawn from this accumulated evidence sufficiently conclusive to establish the conviction that the mind continues to exist after the dissolution of the body?

For the satisfactory determination of this question, it will be necessary to concentrate the evidence derived from each of the three parts into which the subject has been divided, that it may be brought to bear effectively upon that point. Each of the divisions of our subject is independent, and complete in itself, and the object proposed in their separate investigations was to arrive at the same conclusion — the future existence of the soul — by pursuing different courses of inquiry; so that, by extending the number and variety of the instances, we might give additional weight to the argument founded on their distinct and various testimonies. Had any one of the three leading divisions of our ar-

gument stood alone, the inferences to be drawn from the consideration of the different branches into which each is subdivided would, we contend, be sufficient to produce moral certainty of the existence of the soul after death; and the proofs afforded by the indestructibility of matter, the properties of matter, and the phenomena of life, collectively, present a body of evidence in support of that position, which amounts, it is conceived, to little less than positive demonstration.

Though the arguments founded on the indestructibility of matter — the properties of matter — and the physiological consideration of the phenomena of life — are, as we have just observed, separately independent, and are not consequent upon any inferences derived from their antecedents, yet these cumulative proofs mutually tend to confirm each other, and thus give additional strength to the arguments which they separately affirm.

Having, for instance, established the fundamental truth that matter is indestructible, and that no substance can be annihilated without the direct interposition of Divine Power, it follows, as a necessary consequence, that the subtile properties of matter — the continued existence of many of which may be traced from the creation of the universe — are also indestructible. Having, in the second place, proved that the proper-

ties of matter are subtile principles distinct from, and independent of, the material particles with which they are combined, we are led to infer, that the still more subtile principle of the mind — to the developement of which those properties are subservient — is also distinct from, and independent of, matter and its properties. Again; as all matter and its properties are indestructible, we conclude that the ethereal principle of the mind — which is infinitely superior in all its other attributes to the properties of matter — participates in the attributes of durability and immutability which are possessed by the inert particles of all material substances. These deductions are confirmed when we find, in the third place — from investigating the connection of mind with material organisation — that that ethereal essence is distinct from the organised system with which it is combined, that it can act independently of material organs, and that its elements must exist prior to the formation of the material frame by which its powers are manifested.

Now, when we find that the consideration of the imperishable and unchangeable nature of matter establishes, by well-sustained induction from analogous facts, the existence of the soul after death, — that we arrive at the same conclusion from the distinct consideration of the properties of matter, — and that, when we proceed with

the inquiry, and examine the nature of the connection between mind and material organisation, we are led to the same end, — the attainment of these corresponding results from the investigation of so many and such different natural laws and phenomena, ought surely to be regarded as satisfactory as any evidence that it is possible to procure, in support of the truths of inductive science. These cumulative proofs also derive additional importance from the circumstance, that the separate ascending links of the inquiry — though distinct and independent — mutually support each other; and when combined, they constitute, as we contend, a complete and irrefragable chain of communication between the present and a future world.

In addition to the evidence alluded to in the foregoing retrospect, other facts and illustrations were brought under notice, during our inquiries, which, though they cannot be adduced directly in support of our argument, are of great importance in combating the objections raised against the immateriality of the soul. We refer, more particularly, to the numerous instances wherein we had occasion to remark upon the utter incapacity of the human intellect to arrive at the first causes of even the simplest processes of Nature; and the consequent irrationality and presumption of assuming that the operations of an omnipotent and omniscient Power are circum-

scribed within the narrow bounds of our comprehension.

The principal objections that have been raised to the immateriality of the soul are founded upon the incapacity of the intellectual powers of man to comprehend a state of existence separate from material organisation. The best possible answer to this objection is, that the human intellect is insufficient to apprehend the nature of any one of the phenomena that are continually occurring around us; and that, if the proof of their occurrence depended upon any evidence less conclusive than that of immediate perception, the difficulties and apparent impossibilities which they involve, would be deemed fully equal to those which surround the comprehension of immaterial existence. It was with the view of impressing this important consideration more fully upon the mind, that we adduced, in the course of our investigations, so many instances of the mysterious and inscrutable operations of the properties of matter, which serve to show how utterly inadequate our mental powers are to understand the nature of those subtile properties, or the ultimate causes of their innumerable physical actions and changes; which are equally incomprehensible as the nature of that change which we presume takes place on the separation of the soul from its material agents. We went still farther, and undertook to prove, even upon the

hypothesis that the existence of the mind depends entirely upon an organised material system — that the *matter of mind* must be distinct from the *matter of organisation;* and that the difficulty attending the comprehension of the processes of life would be rather increased than diminished, by attributing them to material agency.

The most specious arguments of the materialists depend upon the intimate connection subsisting between the mind and the body in every stage of existence, and in every condition of the corporeal tenement. On the birth of an infant, all the organs adapted for the maintenance of animal life are in a perfect state; whilst those which are appropriated to the perceptive and intellectual faculties are incomplete, and are only developed gradually, and in a corresponding degree with the developement of the intellectual powers. When the material organisation has attained its greatest perfection, we perceive the mind to be in its greatest vigour; when disease enervates the body, the generally accompanying languor of the mental powers indicates their sympathy with the material system; and when, in the decline of life, the diminished action of the animal functions and the increased rigidity of the muscles and other animal tissues bring on the infirmities of age, the faculties of perception and memory, of thought and judgment, fail, and

the mind seems to sink into the grave even more rapidly than the body.

It must be admitted, that the apparently necessary dependence of the sentient and intellectual faculties upon material organisation, exhibited on a first view of the phenomena of life, tends to countenance the notion that the functions of the mind cannot be exerted without the aid of material organs; and if we possessed no other evidence respecting the operations of the mind, and its connection with matter, than is afforded by external appearances, we might be induced to assent to that opinion. But having, in our investigations into the mysterious phenomena of life, ascertained that the sentient and thinking principles are distinct from matter—that they can act independently of the organs of perception, and must have existed prior to the construction of material organisation — we are thence taught to view the brain merely as the apparatus for developing the powers of the mind, and to consider that any deficiency in the proper developement, occasioned by injury, or by the decay of the apparatus, is no more indicative of the decay of mental power, than any derangement in the machinery of the steam-engine, which impedes its action, is to be considered indicative of the loss of the expansive power of heat, by which it was previously set in motion. We admit the difficulty of comprehending by what possible means those powers of the mind can be pre-

served during the decay of its apparatus, but equal difficulties occur on the consideration of every question in science, however simple, when we attempt to discover ultimate causes.

This subject has been frequently discussed during the course of our inquiries respecting the phenomena of life, when the objections founded upon the close connection subsisting between the mental faculties and the animal frame were anticipated and answered. It must be borne in mind, also, that in the view we took of those phenomena, it was our especial object to consider the intimate relations subsisting between mind and matter; and our principal and most direct arguments to prove the mind to be distinct from, and independent of, material organisation, were founded on those considerations.

If we assume — as every one must do who admits the existence of matter, — that the mind is intimately connected, under every circumstance, with material organisation, and that the brain is the more immediate agent of the mental powers in all their relations with matter, we cannot fail to perceive, that the outward visible signs of those powers must depend upon the condition of the agent by which alone their actions can be manifested to the material senses. The injury or decay of the agent must, therefore, necessarily impair the power of mind in its actions on matter, as it is only through the

medium of material organs that its existence is appreciable; but the assertion that this reciprocal sympathy between mind and matter implies absolute identity, is opposed to the best established deductions from the consideration of the phenomena of life and the attributes and properties of matter, and it is founded only on the incapacity of man to apprehend the nature of immaterial existence, and the consequent limitation of his views to secondary causes.

The consideration of the progressive stages in our acquirement of knowledge is sufficient to show, that, as the mists of ignorance are dispelled, the chain of causation is seen to extend from proximate agents to others which are more and more remote; and the ideas which mankind generally entertain respecting their own knowledge of first causes, will be found, on examination, to be in inverse proportion to the extent of their scientific attainments. The effects of the most common phenomena are ascribed by those who have paid no attention to the pursuit of science to the immediately observable causes. These causes, they conceive, afford a perfectly satisfactory solution of the processes and changes; and such observers imagine, when they perceive the immediate agent which produces the phenomenon, that they have detected its ultimate cause; when, in fact, they have made scarcely any advance in the progress of causation, and have been

confining their views only to the effects of more occult agencies. The utmost stretch of even the best cultivated human faculties, indeed, will only attain the examination of the lower links of the chain which leads from effects to their primary causes; and, as man advances in knowledge, he feels more and more conscious of his inability to penetrate the great secrets of Nature, and he becomes convinced that the last causes at which he can arrive are very distant from that original source whence the effects he has been examining emanate.

As an illustration of the foregoing observations, let us suppose, that a man who is ignorant of the nature of heat were called upon to explain the cause of a fire burning in the grate. He might imagine, when he stated that it was caused by the burning of the coals, that he had mentioned the primary cause of the phenomenon, and that such a reply would be a satisfactory answer to the inquiry. When, however, he had advanced some steps farther in the progress of causation, he would discover that the coals are not the substances burned, and that the heat and light of the fire are produced by the chemical union of the component parts of the coal with a portion of the atmosphere; that this union, again, is effected by the property of chemical attraction subsisting among the elementary particles of the substances, and that the

heat given out by the process is merely evolved, or excited, by the rapid chemical action with which the combination of the hydrogen and oxygen is effected. He would learn, also, that the heat is not created by this chemical action, but that it exists prior to the commencement of the process; and that neither the quantity of absolute heat, nor the quantity of matter apparently consumed, is diminished or increased by the largest fire. The result of his inquiries would, therefore, show that what he formerly believed to be the primary cause of the fire, is in reality only a subordinate effect, produced by the operation of two other mutually depending causes, and that those causes do not produce the heat, but are merely the agents in its developement. By prosecuting the inquiry to this point, he will therefore arrive at a knowledge of the existence of two subtile principles or properties of matter, —chemical attraction and heat; but of the nature of those properties he can procure no information. So far as our knowledge extends, they are ultimate principles; but as our only reason for believing them to be so is, that we are unable to pursue the analysis farther, the foundation for such a belief is extremely slight. In every branch of science we are thus led onward from effects to causes, until we reach the extreme limits of our mental powers; and we are then obliged to refer to higher causes, to which

those principles we have been investigating are only the subservient agents.

If we apply the same analytical process to physiological science, we shall find that primary causes recede as we advance in the inquiry, even more remarkably than in the foregoing illustration.

The first or lowest link in the chain of mental phenomena that comes within our cognisance is that of sensation or perception. Perceptions, which constitute the foundations of our ideas, are retained and stored in the mind by the power of memory; the materials thus prepared are brought into action by the faculty of thought; and they are arranged and compared by the reasoning powers. On the ideas that have been in this manner perceived, retained, recalled, and compared by the mind, the judgment at last decides; and another power—volition—may then act in accordance with that decision, and compel the members of the body to obey its mandates. The operations of the mind, we therefore perceive, correspond with those of physical phenomena, in observing a regular series of progression from effects to causes, until our inquiries are stopped by arriving at a mysterious, incomprehensible power, which, owing to our inability to discover any subordinate agency, we are fain to consider an elementary principle. We are so profoundly ignorant respecting all the operations

of the mind, that there can scarcely be degrees of difference in our knowledge of those mental processes we have enumerated; yet we may presume, from analogy, that if we were enabled to comprehend the nature of perception, we might still be incompetent to understand the modes by which the higher operations of the mind are performed, or the nature of the energies of volition. The latter subtile principle is connected with the animal organisation by a complicated apparatus of nerves specially provided for the discharge of its important functions. The whole construction of the human frame, indeed, appears to have reference to the due exercise of this power. By what means, however, the stimulus of the nerves of volition causes the muscles to contract, we are unable to discover; and the nature of the process by which the stimulus is conveyed from the brain to the nerves, — the causes of its excitation and of its duration in certain channels, and in various degrees of energy, — are questions which seem to be involved in mysteries far too subtile and impenetrable for the human faculties to elucidate.

We thus perceive that the phenomena attending the exercise of the power of volition on material organs, present the same progressive advances from effects to their immediate causes, and the same fruitless search after a primary

actuating principle, which marks all our endeavours to discover the ultimate sources of natural or mental phenomena. We observe, for instance, the admirable disposition of the bones and the muscles, and their beautiful mechanical contrivances for moving most energetically with the least waste of power; we are enabled to discover that the irritability of the muscular fibres is excited, and that their consequent contractions are produced, by the nerves. In examining the nervous system physiologists have detected two distinct sets of nervous fibres, appropriated to volition and to sensation; and we are able to trace the source of both those sets of fibres to the brain. There, however, our researches terminate; and we cannot, by the most intense application of thought, form any conception of the cause that communicates motion to a single finger. We may, perhaps, conceive we have assigned the cause when we ascribe volition to the power of judgment and the imagination; but, as we know absolutely nothing of the nature or operation of those faculties, we are thus only referring from one unknown cause to others equally incomprehensible; and we are obliged at last to admit the agency of some superior ulterior power, the existence of which is inscrutable to material beings.

Whether we consider the means by which the matter of the human frame is assimilated, ac-

creted, and organised, or the manner in which the different organs discharge their respective functions, we are obliged to refer those processes to the agency of some latent power distinct from the organs themselves. This power, it is presumed, resides in the brain; which substance serves as the immediate agent of perception, and of all the moral and intellectual faculties. The examination of the structure, and the analysis of the constituent parts, of the brain, however, present no appearances, nor indicate any inherent qualities, which, in the most distant degree, correspond with the sensations which its agency excites. It has also been shown, that the substance and organisation of the brain cannot be produced without the aid of some active principle, entirely distinct from, and existing antecedent to, the mere arrangement of material particles of which the brain is composed. What foundation, therefore, is there for supposing that the brain alone, of all the material organs, is the ultimate cause of the functions it discharges? Whence are we led to infer, excepting from our inability to pursue the train of causation farther, that that organ is the supreme governor of all the complicated functions of animal and intellectual life, and is itself the origin as well as the agent of all our thoughts, feelings, and actions?

It has been observed, by one of the most ingenious and zealous supporters of the system

of materialism, that "the same kind of facts, the same reasoning, the same sort of evidence altogether, which show digestion to be the function of the alimentary canal, motion of the muscles, the various secretions of their respective glands, prove that sensation, memory, judgment, reasoning, thought, in a word, all the manifestations called mental or intellectual, are the animal functions of their appropriate organic apparatus, the central organ of the nervous system. No difficulty nor obscurity belongs to the latter case, which does not equally affect all the former instances; no kind of evidence connects the living process with the material instruments in the one, which does not apply just as clearly and as forcibly to the other." *

It will be seen, therefore, from the preceding extract, that the utmost extent to which this zealous materialist endeavours to carry his principles is, to establish the same relation between the organisation of the brain and the intellectual faculties, which subsists between the various functions of the body and the organs by which they are discharged. The immediately succeeding passage, which we quote as being clearly illustrative of the position we have been endeavouring to maintain, shows that, after having attained this object, he is obliged to refer to some un-

* Mr. Lawrence's Lectures on Physiology, &c.

known mysterious cause, by whose agency the operations of the brain are performed : —

"Shall I be told that thought is inconsistent with matter; that we cannot conceive how medullary substance can perceive, remember, judge, reason? I acknowledge that we are entirely ignorant how the parts of the brain accomplish these purposes—as we are how the liver secretes bile, how the muscles contract, or how any other living purpose is effected — as we are how heavy bodies are attracted to the earth, how iron is drawn to the magnet, or how two salts decompose each other. Experience is, in all these cases, our sole, if not our sufficient instructress; and the constant conjunction of phenomena, as exhibited in her lessons, is the sole ground for affirming a necessary connection between them. If we go beyond this, and come to inquire the manner how — the mechanism by which —these things are effected, we shall find every thing around us equally mysterious, equally incomprehensible."

Now, if it be admitted that the organisation of the brain is of itself insufficient to develope the intellectual faculties without the supervention of some mysterious directing power, we are at once carried, by the materialist himself, beyond the sphere of material systems; and we are brought to the consideration of a subtile active

principle, superior to organised matter. Whatever be the presumed nature of this incomprehensible agent — whether it be presumed to be material or immaterial — if the existence of a principle distinct from the organisation of the brain be admitted, the materialists have no longer any foundation whereon to rest. No conceivable combination of matter is capable of being set in motion without a moving power; and whatever view we take of the question, we are obliged to look beyond the inert matter of the brain for the vital principle which animates and governs the corporeal and intellectual organs of the human frame.

The difficulties in which the materialists are involved, in their attempts to ascribe the operations of the mind to material agency, and the necessity in which they are placed of admitting the existence of some mysterious governing power to account for the phenomena of life, are thus forcibly stated by Mr. Whewell: —"Those theorists who have maintained most strenuously the possibility of tracing the phenomena of animal life to the influence of physical agents, have constantly been obliged to suppose a mode of agency altogether different from any yet known in physics."—"The history of living beings only begins with sense and consciousness, the developement of which is, even by the beforenamed theorists, supposed to originate with some

mode of agency different from physical causes. Instincts, affections, passions, will, are also possessed by living beings; and how lost and bewildered do we find ourselves, when we endeavour to conceive these faculties communicated by means of general laws! Yet they must be so communicated by God, and of such laws he is the Lawgiver. But we have still to go farther, and far higher. The world of reason and morality is the same creation as the world of matter and of sense. These depend on the laws of man's nature, no less than the laws of his material existence or his animal impulses." *

In commencing our inquiries, we assumed the fundamental truths of Natural Theology to be taken for granted. The existence of a supreme Creator is manifest through all the works of nature; and the incontestible evidence adduced by Archdeacon Paley, and by other able writers, to prove the existence of a Supreme Intelligence, seems to have placed that important truth beyond the reach of controversy. If, therefore, the innumerable proofs of intelligence and power in the works of Nature manifest the existence of a supreme omniscient and omnipotent Creator, it is strictly within the range of our present inquiry to avail ourselves of any argument that can be founded on that demonstra-

* Mr. Whewell's Bridgewater Treatise.

tion. Were we, indeed, to pursue the train of reasoning which this subject suggests, we might be led into a wide field of investigation, incompatible with the limits of this volume; but there are a few considerations, wherein the proofs of the existence of the Deity in his works appear to bear more particularly on the views we have taken in support of the argument for a future life, that should not be omitted in a comprehensive survey of the natural evidence on which that argument is founded.

In the first place, we obtain from Natural Theology a direct confirmation of the inference drawn from the results of all our researches — that there is an ulterior power, operating beyond the last point to which we are enabled to trace material agency. Having, therefore, found that every branch of science, and all the phenomena of life, point to some subtile cause superior to any which we are enabled to investigate; and having discovered, from the evidences of Natural Theology, that there does exist a Presiding Intelligence over the universe, omniscient to design, and omnipotent to effect, we are conducted directly to the Great Actuating Cause that governs the infinitely varied modifications of matter.

The relations we are thus enabled to establish between the material world and a supreme govern-

ing Power, complete the chain of evidence by which we have endeavoured, in our previous investigations, to connect the operations of a system of organised matter with immaterial agency. They afford also a most satisfactory answer to the objection that has frequently been urged by the materialists, "that to adopt an opinion which supposes material effects to be produced by other than material causes, is to form an hypothesis without a single fact to support it." So far, indeed, is this assertion from bearing the test of experience, that not one single material effect can be pointed out which, when strictly examined, will not be found to depend upon subtile causes, distinct from our ideas of matter; and when we view physical phenomena in their relations to the presiding omniscient Power, who made and who governs the universe, we are necessarily obliged to refer the cause of every material action to immaterial agency.

It is not within our province to inquire into the nature of the soul of man — whether it be a direct emanation from the Deity, or whether it be a comparatively subordinate agent, governed, like the material world, by established laws. We know, however, that it was created by an all-wise Power existing throughout eternity; and whether it be a divine emanation or a distinct immaterial principle, we cannot — on the admitted assumption that it is a creation of Divine

Power — suppose it to be otherwise than immortal, without forming an hypothesis opposed to the knowledge we have gained respecting the properties and elements of all created things.

Another consideration suggests itself in connection with the existence of an omniscient, all-powerful, and spiritual Governor of the universe, that serves to remove any doubt which might remain relative to the possibility of the mind existing entirely independently of material organisation. Though we are enabled, by attentively studying the works of Nature, to attain a knowledge of some of the attributes of the Deity, it is utterly beyond the sphere of our intellectual capacities to comprehend the supreme, mysterious, and ineffable nature of the Divine Power. We see every where around us convincing proofs of a constantly sustaining Providence, whose operations are never suspended, and are equally apparent in the awful bursts of the tempest, and in the refreshing shower, — in the formation of the system of the universe, and in the construction of the smallest leaf, — yet, though we perceive the effects which indicate the presence of the great creating Power, we see not the Power itself. The Deity acts in ways too subtile for the apprehension of our corporeal faculties, and is perceptible only in his works. Being conscious, therefore, that the great Author of Nature produces all the wondrous and mys-

terious effects which we behold by means of immaterial agency, can we hesitate to admit that the functions of the human mind may also be discharged by the exercise of immaterial power? We cannot, it is true, conceive how sensation can be produced otherwise than by the organs by means of which we are accustomed to receive impressions from external objects; but when we learn that infinite wisdom and infinite power are manifested without the aid of material organs, we must conclude that the same causes which are adequate to produce the greatest possible effects, are also adequate to produce effects which are comparatively insignificant.

In the foregoing epitome of the leading features of the evidence in support of a future life derived from the phenomena of Nature, we have necessarily omitted numerous minor points, that contribute by their accessory testimony to establish our position. The difficulty that we have had to contend with does not arise from any deficiency, but from the actual redundancy, of corresponding evidence in the three divisions of our subject, which renders the concentration of the whole within one field of view almost impracticable.

Had we to rely solely upon the arguments founded on the indestructibility of matter, they might have afforded satisfactory assurance that the sentient principle is also imperishable. The

investigation into the subtile properties of matter, and the consideration that they are distinct from, and independent of, the material substances which they control, might have reasonably led to the conclusion that the soul is distinct from, and independent of, the material organisation which is subservient to its will. The phenomena of life, again — which require for their first evolution a pre-existing power, distinct from the properties of matter, competent to dispose the elementary particles in their organic arrangements, and which in their more advanced processes exhibit the mind as distinct from material substance, and capable of acting independently of the organs of sensation — would alone lead directly to the conclusion that the soul is immaterial and immortal. When these three branches of our subject — each one of which is, we contend, sufficient to establish a satisfactory belief in a future state of existence — are taken collectively; and when the array of evidence they present is viewed in connection with the fundamental truths of Natural Theology, the testimony thus afforded of a future state of existence is scarcely less conclusive than demonstrative proofs. It must be borne in mind, also, that each branch of the inquiry, at the same time that it affords evidence to establish our general argument, furnishes answers to the principal objections that are raised against the immaterial and sepa-

rate existence of the soul; for all investigations into the properties and actions of material bodies serve to show that the incomprehensibility and apparent impossibility of a state of existence apart from material organisation is not greater than the inscrutable mysteries and apparent impossibilities which surround and accompany the causes of every phenomenon we behold.

No one, we feel persuaded, would refuse his implicit assent to any proposition in physical science that rested on much less solid foundation than that afforded by natural evidence for the belief in a future life; and shall we hesitate to receive the proofs in the latter case, because they affirm a proposition the most interesting that can be submitted to the consideration of man? Shall that evidence, which would carry conviction in all cases connected with our relations to material creation, be deemed invalid only when it coincides with that innate feeling which prompts all mankind to look beyond the present world to another and a superior state of existence?

It is not within the limits of the human intellect to form an idea of a being existing and receiving sensations without the aid of material organs; and we are consequently ignorant of the condition of such an existence after death. We infer, however, from those considerations respecting the immutability of the elements of matter — and particularly from those respecting

personal identity—to which our attention has been directed, that one of the essential conditions of a future state must be the continued consciousness of a former existence. Beyond this, it is useless to speculate.

The transition from a state of consciousness manifested by material organisation, to a condition of being wherein the intellectual powers are developed by immaterial agency, does not necessarily imply the destruction, nor even the suspension, of our existing intellectual faculties. Several analogies may be pointed out in natural phenomena, which seem favourable to the opinion that death is only a preparatory change of condition, analogous to that of our birth, and that it will usher us into a new sphere of action, with a continuous consciousness of our existence, and a continued exercise of our mental powers. It has been well observed on this subject, by an eminent author,—"There appears so little connection between our bodily powers of sensation and our present powers of reflection, that there is no reason to conclude that death, which destroys the former, does so much as suspend the exercise of the latter, or interrupt our *continuing* to exist in the like state of reflection which we do now. For suspension of reason, memory, and the affections which they excite, is no part of the idea of death, nor is implied in our notions of it. And our daily experiencing these powers to be exer-

cised without any assistance that we know of from those bodies, which will be dissolved by death, and our finding often that the exercise of them is so lively to the last; these things afford a sensible apprehension that death may not perhaps be so much as a discontinuance of the exercise of these powers, nor of the enjoyments and sufferings which it implies. So that our posthumous life, whatever there may be in it additional to our present, yet may not be entirely beginning anew, but going on. Death may in some sort, and in some respects, answer to our birth; which is not a suspension of the faculties which we had before it, or a total change of the state of life in which we existed when in the womb; but a continuation of both with such and such great alterations." *

The knowledge that the divine, omnipotent Creator of the universe is a spiritual Being whom, excepting in his works, "eye hath not seen, nor ear heard," is sufficient to prove that the exercise of the intellectual powers possessed by man is perfectly compatible with immaterial existence. Not only, indeed, is the exercise of the intellectual faculties consistent with immaterial agency, but we may reasonably infer, from the analogies presented during the whole course of our investigations, that when

* Bishop Butler's Analogy of Religion to the Constitution and Course of Nature.

the mind is detached from matter, it will exert its energies with greater vigour than when fettered by its connection with the corporeal machine; and that when perceptions are received and reflected on directly by the mind, without the intervention of material organs, or material processes, they will be more clear and comprehensive, and that the real nature and properties of the objects perceived will be divested of that obscurity in which they are involved when viewed through the medium of subordinate instruments.

All the phenomena of Nature point to immaterial agents as their ultimate causes; and as we pursue the investigation into the more intricate processes of the properties of matter, every material and visible agent refers us to a subtile and invisible cause, which is past finding out. It is only when we take our position on the low level of ignorance that our views are limited to the material objects which immediately surround us; but when we occupy the vantage ground of science, our views are expanded, we behold other and more distant scenes, and the mind is raised above this world to survey the prospect of a superior, a better, and a more enduring state of being.

In the course of the foregoing inquiries, we have necessarily been limited, by the nature of

our subject, to the consideration of those tangible and visible phenomena that indicate the power and wisdom of the Author of Nature; and those inquiries have led to the conclusion that the soul of man is created for another state of existence. The same conclusion at which we have arrived from the investigation of natural and mental phenomena, might also be attained by the consideration of the moral attributes of the Deity. Every work of creation manifests that the goodness and benevolence of God is to be equalled only by his knowledge and power; and we are hence led to infer that our capacities for enjoyment, surpassing the gratifications of this world, and our ardent aspirations for a state of future bliss, have not been bestowed on us without an object, and that they will be realised in some other sphere of action. The physical and the moral government of the world concur in pointing to another state of existence, wherein the mysterious decrees of Providence and the hidden secrets of Nature will be justified and explained; and they thus unite in confirming the important truth made known to mankind by Revelation. From this view of the subject we are, therefore, led to perceive the relations subsisting between natural science, moral philosophy, and Revelation: the first guides us to a knowledge of a future life; the second confirms that truth, and teaches also that the next scene of

our existence will be fitted for a higher state of moral and intellectual enjoyment; and Revelation informs us that the happiness or misery of the future will depend upon our conduct in the present world.

THE END.

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